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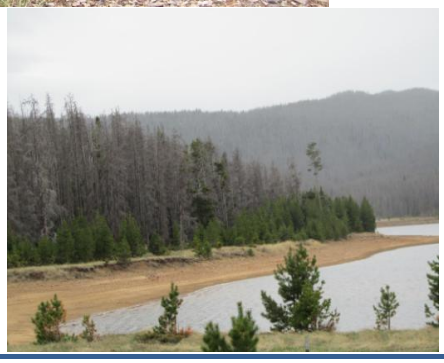
Preliminary Environmental Document

Red Mountain Flume Chessman Reservoir Project

Helena National Forest
Lewis & Clark County, Montana



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INTRODUCTION

The Red Mountain Flume Chessman Reservoir (Flume Chessman) Project consists of about 490 acres of treatments on forested lands along the Red Mountain Flume and around the Chessman Reservoir located in the Upper Tenmile Watershed about 10 miles southwest of the city of Helena. Proposed treatments include the cutting and removal of dead and dying trees, thinning of live trees, removing large downed fuels, and prescribed burning. This is the primary municipal watershed for the city of Helena and is located on the Helena Ranger District of the Helena National Forest (HNF).

The flume is a man-made channel that diverts water from Banner Creek around Red Mountain to Chessman Reservoir, which helps provide a constant, regulated supply of water to the Tenmile Water Treatment Plant near the confluence of State Highway 12 and County Route 695 (Rimini Road).

The length of the flume is about 4.8 miles of which 2.1 miles are on private and 2.7 miles on Forest Service system lands. The flume is comprised of about 13,000 feet of unlined ditch, 11,800 feet of sheet metal flume, and 500 feet of pipeline. Wood trestles in nine separate locations support about 20% of the flume. If a major wildfire was to occur that damages the flume and increase sediment into the flume and reservoir, the city would likely not be able to use this municipal water system for a minimum of 23 months (FEMA2008). This concern prompted action by the city of Helena to work on diminishing that threat by reducing fuels along the flume on private lands. Likewise, it is prudent that the Forest Service analyze similar treatments on public lands.

This project is a small piece of the larger landscape-scale evaluation being considered for the Upper Tenmile Watershed. In that evaluation, options will be assessed regarding the overall resource conditions and landscape needs of the greater Tenmile Watershed. In the meantime, there is an immediate need to address forest conditions adjacent to the flume and reservoir.

The Forest Service has prepared this environmental document in accordance with the National Environmental Policy Act (NEPA) and the Administrative Procedures Act (APA). This document discloses the foreseeable environmental effects of the Flume Chessman Proposal for determining whether or not to prepare an environmental impact statement (EIS) or if not significant, a Finding of No Significant Impact (FONSI). This due process will also be fulfilling the requirements for Forest Service Regulation 36 CFR Part 218 subparts A & B – *Project-Level Predecisional Administrative Review Process*.

Reports cited in this document can be obtained upon written request from the Helena Ranger District office in Helena, Montana or from the Helena National Forest website (www.fs.fed.us/r1/helena/).

NEED FOR THE PROPOSAL

The purpose of this project is to reduce the likelihood of physical damage to the municipal watershed infrastructure (flume and reservoir) in the event of a wildfire or falling trees.

The Mountain Pine Beetle (MPB) infestation roughly began in 2006, peaking in 2008 and 2009. The outbreak has now subsided, largely due to host depletion (Milburn, Forest Vegetation Report, p. 30, 2013). This MPB caused wide-spread tree mortality will result in elevated surface fuel loadings across the Tenmile Watershed including the project area in the relatively near future as dead trees fall.

Currently, along the flume and around the reservoir, tree species composition of most stands is 90%+ lodgepole pine with lesser amounts of Douglas-fir, subalpine fir, spruce, five needle pine, and aspen. The lodgepole stands exhibit >90% mortality from MPB, while other species have been impacted by western spruce budworm or white pine blister rust. (Milburn, Forested Vegetation Report, p. 28, 2013). These dead lodgepole pine dominated stands are expected to begin falling within 5 years after death with 90% anticipated falling by year 14 (Mitchell and Preisler 1998).

The expected surface fuel loading will create conditions in which a fire would burn intensely, with long duration, and would be difficult to suppress. The result of an intense fire of this nature would pose a risk to the flume structure, and could lead to post-fire erosion, sedimentation, ash deposition, and/or physical damage related to debris torrents that may impair the functionality of the flume and reservoir. Also, dead and dying hazard trees near the flume pose a risk of physical damage to the structure when they fall (Thompson, Fire and Fuels Report p. 1, 2013).

The flume and reservoir are critical interconnected/interdependent infrastructure necessary to maintain Helena's municipal water treatment system. Currently the city of Helena uses the Tenmile watershed as its primary municipal water source. If a major wildfire were to occur in the Tenmile drainage that damaged the existing flume structure and also increased sedimentation into the Red Mountain flume and Chessman Reservoir, the city would likely not be able to utilize the Tenmile water system as a municipal water source for a minimum of 23 months (FEMA 2008, page 1-2). Post fire results could lead to accelerated erosion, ash deposition, and physical damage related to debris torrents that could impair the functionality of both the flume and reservoir.

The city of Helena uses the Missouri River as an additional source of water to supplement the Tenmile Water Treatment Plant during times of peak usage. The Tenmile plant is a gravity fed system while the Missouri Water Treatment plant requires pumping of the water to a higher elevation into city limits. There are also cost differences between the two water supply systems. Should a scenario play out that eliminates the existing Tenmile system as a water source for an undetermined period of time, the city of Helena would have to rely solely on the Missouri River system. This would result in an increase cost to the city and require water restrictions during periods of high demand.

There are other additional costs and consequences that are associated with relying on the Missouri River system as the only source of water. An immediate upgrade of the pumping facility would be required to accommodate the increased water demand from the Missouri river system. Lastly, the

westside of Helena would experience water pressure issues when only using the Missouri River Plant, particularly the area around Fort Harrison and the Veterans Administration offices.

The immediate goal of the project is to have forested stands along the flume and around the reservoir in a condition that would lower the risk of high-severity wildfire effects, thus limiting the potential of damage to the municipal watershed infrastructure. This project would contribute to the Helena Forest Plan (HFP) goal for the Upper Tenmile Watershed to "Maintain high quality water to protect…municipal water supplies…" (HFP, p. II/1, April 1986) and HFP Management Areas (MA) direction within this project area to "provide a quantity and quality of water which will, with adequate treatment, result in a satisfactory and safe domestic water supply" for the city of Helena (HFP MA H1, p. III/17 & MA H2, p. III/20, April 1986).

It has been determined through internal analysis and discussions with interest groups such as the city of Helena and the Ten Mile Watershed Collaborative Committee that concerns for the flume and reservoir should be addressed immediately. Therefore, there is a need to:

- Remove standing vegetation and high fuel loadings along the Red Mountain Flume designed to lower the risk of damage to infrastructure from wildfire effects, post-fire effects, and probable direct damage from fallen trees.
- Remove dead and dying trees, surface fuel loading and the density of live trees near Chessman Reservoir intended to reduce risk of a severe wildfire, which could lead to post-fire erosion, sedimentation, and ash-flow to the reservoir.

In the future, in order to meet the intent of the above HFP direction, the HNF would look to maintain the forest directly around the flume in an open condition to function as a shaded fuel break, reducing the potential harm from fire or fallen tree damage. In order to maintain the forest around the flume an open condition a conveyance of a 100 foot Right of Way on each side of the flume to the city of Helena is being evaluated. Natural regeneration would be expected, therefore, thinning and potentially handpiling/burning may be needed through time to maintain the desired conditions.

For the forest stands around Chessman Reservoir, the short-term objective is to remove most of the dead and dying lodgepole pine while retaining scattered patches of live regeneration or individuals of surviving trees of other species, where they occur. The remnant patches and individuals will provide for some diversity in structure in these areas. Healthy regeneration would be established in the short-term and would be maintained through time as a stocked stand, but in a less dense condition from the current levels. This would enhance the vigor of these forest stands and would likely reduce their susceptibility to future insect infestations and wildfire.

NEED FOR A SITE-SPECIFIC FOREST PLAN AMENDMENT

Our preliminary analysis for this project indicates a need to amend the 1986 Helena National Forest Plan for lands encompassed by the Red Mountain Flume/Chessman Reservoir Project with regards to elk hiding cover and security.

Elk serve as a management indicator for hunted species for the Helena National Forest (Forest Plan p. II/17). Federal laws and direction applicable to management indicator species include the National Forest Management Act (NFMA) as well as the Forest Plan. The NFMA requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 USC 1604(g) (3) (B)]. Forest Plan Standards are in place to ensure that this requirement is satisfied.

The Forest Plan contains Forestwide big game standards and standards specific to each of the management areas identified in the Forest Plan. The standards that are the subject of this site-specific amendment are:

Standard 3: *Subject to hydrologic and other resource constraints, elk summer range will be maintained at 35 percent or greater hiding cover and areas of winter range will be maintained at 25 percent or greater thermal cover in drainages or elk herd units.*

Standard 4(a): *Implement an aggressive road management program to maintain or improve big game security.*

a. Road management will be implemented to at least maintain big game habitat capability and hunting opportunity. To provide for a first week bull elk harvest that does not exceed 40 percent of the total bull harvest, roads will be managed during the general big game hunting season to maintain open road densities with the following limits.

Table 1: Forest Plan Hiding Cover/Road Density

Existing Percent Hiding Cover (1)	Existing Percent Hiding Cover (2)	Max Open Road Density mi/mi^2
56	80	2.4
49	70	1.9
42	60	1.2
35	50	0.1
(1) Forest Service definition - a timber stand which conceals 90 percent or more of a standing elk at 200 feet; (2) MT Fish, Wildlife, & Parks definition - a stand of coniferous trees having a crown closure of greater than 40 percent.		

The existing hiding cover to open road density ratio should be determined over a large geographic area, such as a timber sale analysis area, a third order drainage, or an elk herd unit.

There are three elk herd units (EHU) that are part of the project area and are used to measure compliance with these forest plan standards: Black Mountain-Brooklyn Bridge, Quartz Creek, and Jericho Mountain. Currently, both the Black Mountain-Brooklyn Bridge and Quartz Creek EHUs do not meet Standard 4a. Quartz Creek EHU also doesn't meet Standard 3 in the existing condition. The Jericho Mountain EHU currently meets both standards.

Table 2 summarizes the effects to hiding cover under the proposal relative to Forest Plan Standard 3. Approximately 87 acres of hiding cover will be removed in the Black Mountain-Brooklyn Bridge herd unit which is less than a 1% reduction from the existing condition. Approximately 343 acres of hiding cover will be removed in the Quartz Creek herd unit which a 1% reduction from the existing condition.

Table 2: Hiding Cover Proposed for Treatment on Elk Summer Range by Elk Herd Unit

Elk Herd Unit	Total Acres Summer Range	Forest Plan Hiding Cover Acres Existing Condition/%	Forest Plan Hiding Cover Acres Treated	Forest Plan Hiding Cover Remaining Acres Post Treatment	% Forest Plan Hiding Cover Remaining Post Treatment	Meets Forest Plan Standard #3	% Forest Plan Hiding Cover Pre-Treatment (for comparison)
Black Mountain – Brooklyn Bridge	56,339	29,260/52%	87	29,173	52%	Yes	52%
Quartz Creek	36,734	16,477/45%	343	16,134	44%	No	45%

Table 3 summarizes the effects to the hiding cover/open road density under the proposal for Standard 4(a). The open-road density associated with the proposed action would remain the same as the existing condition post-treatment. Approximately 0.5 miles of temporary road would be constructed in the Quartz Creek herd unit followed by full obliteration post-treatment. This road would be closed to the public.

Table 3: Treatment per Elk Herd Unit for Hiding Cover and Open Road Density

Elk Herd Unit	Total Square Miles	% Forest Plan Hiding Cover Existing Condition	Open Road Density During Hunting Season	Forest Plan Hiding Cover Remaining Acres Post Treatment	% Forest Plan Hiding Cover Post Treatment	Meets Forest Plan Standard #4a
Black Mountain – Brooklyn Bridge	88	52%	1.9	29,260	52%	No
Quartz Creek	57	45%	1.1	16,477	45%	No

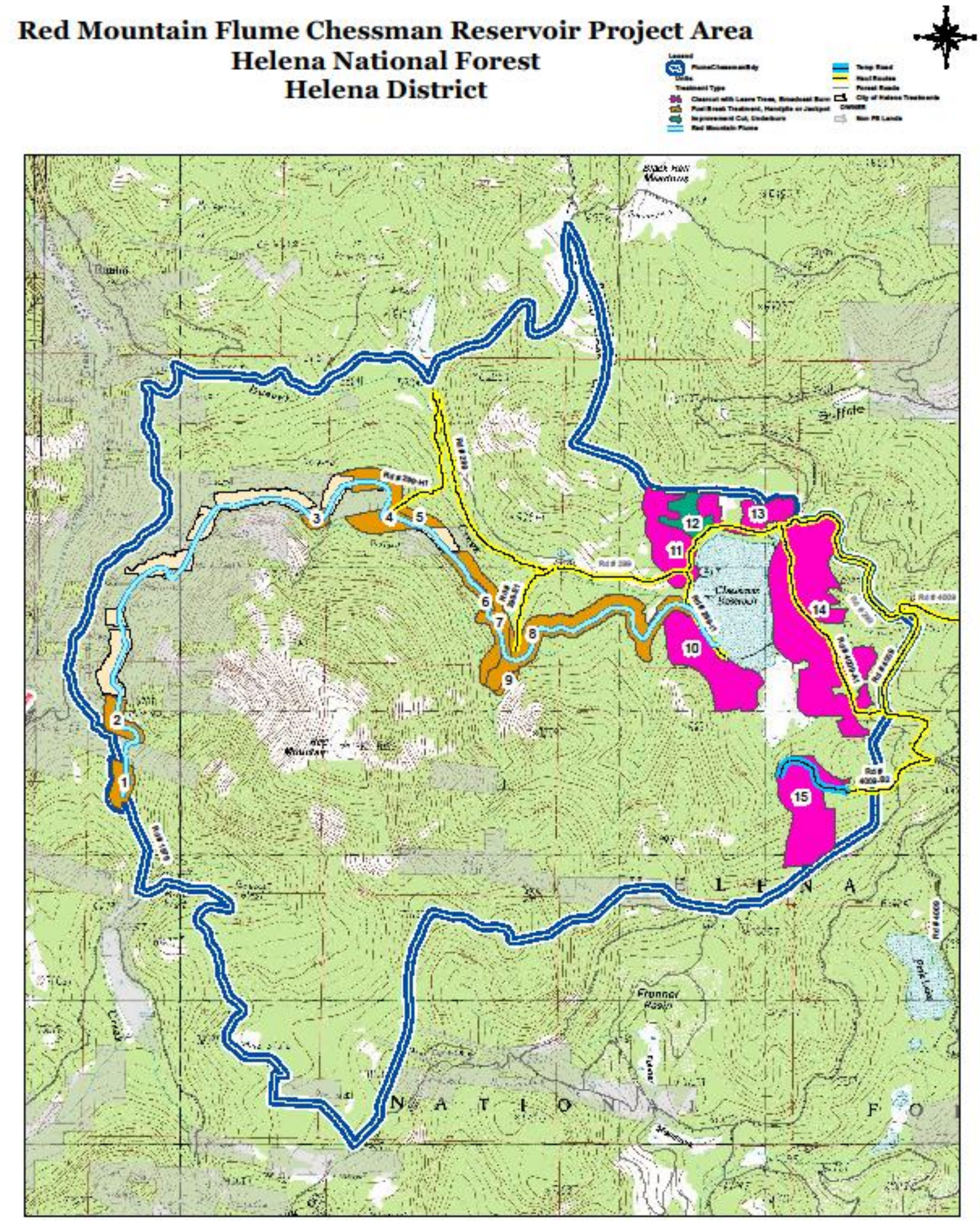
The two EHUs that would be subject to this amendment are located in the Montana Department of Fish, Wildlife, and Parks (MDFWP) Hunting District (HD) 335, which is part of the Deer Lodge Elk Management Unit (EMU). Population objectives for HD 335 are 600 elk, plus or minus 20%. The average late winter elk observation results over the past three years (2011-2013) within HD 335 is 832 elk, which is over current population objectives.

Overall, this project may affect elk to some extent by removing cover adjacent to the Red Mountain Flume and Chessman Reservoir. Regardless of project implementation, this loss will occur naturally over the next few years due to extensive tree mortality and natural tree fall from the insect infestation. However, through the life of this proposal and with the subsequent recovery of hiding cover over time, elk habitat will remain abundant and well distributed across the Forest. It is anticipated that the Forest will retain habitat components necessary to maintain a viable and huntable elk population.

A more detailed discussion and analysis of the proposed site-specific amendment can be found in Appendix A of this document. More discussion and analysis of elk in general can be found in the wildlife section of this document and also in the wildlife specialist report located in the project record.

PROPOSAL & DESIGN FEATURES

Figure 1: Proposed Treatment Units



Proposal

Treatments proposed for the Flume Chessman Project include cutting dead and dying trees, thinning live trees, removing large downed fuels, and prescribed burning, all designed to limit potential damage to the Red Mountain Flume and reduce the risk of high-severity wildfire effects to forest stands directly surrounding the flume and Chessman Reservoir. The drainages that intersect the flume would also be treated up slope from the flume, where feasible, to reduce the probability of erosion and sedimentation in these drainages following a potential wildfire. The proposal's treatments are designed to promote healthy forests while minimizing hazardous fuel conditions in the short- and long-term.

1. *Protection of Red Mountain Flume*: Treatment units are designed to buffer the flume. The goal is to remove fuels and hazard trees to create fuel breaks that lower the risk of fire igniting the structure and the likelihood of post-wildfire erosion and sedimentation. Treatments would complement treatments done by the city of Helena. Tree stocking is not a goal, but some healthy trees would be retained.
    a. *Fuel Break Treatment*: These areas would be treated as a mosaic to create a fuel break. The prescription mosaic would vary at the fine scale based on existing condition. Prescriptions would include clearcut with leave trees (defined below) on an estimated 60%. These areas are dominated by dead and dying lodgepole, and rare scattered residual individual or clumps of fire resistant trees would be retained. The mosaic would also include thinning of hazardous fuels in areas with small diameter and/or living trees (40%). This treatment would include the selective felling of trees for non-commercial hazardous fuels reduction. This would generally entail cutting small diameter trees (<8" diameter), but may also include some larger trees as well. There would be some residual trees left on a wide spacing. All dead and dying trees would be cut, and living trees thinned to a very open spacing to ensure crowns do not touch. Residual spacing would vary based on tree size but generally be greater than 20', and consist of the largest, healthiest, most fire-resilient species available.

2. *Reduction of Potential Wildfire Effects near Chessman Reservoir*: The goal in these units is to reduce the potential for a high severity wildfire which would in turn reduce the probability of post-wildfire ash and sediment delivery into the reservoir. This would be accomplished by treating forested stands near the reservoir to reduce surface fuels, reduce ladder fuels, remove dead and dying trees, re-establish vigorous seedlings where needed, and/or maintain an open canopy of healthy trees where available.
    a. *Clearcut with Leave Trees*: This is a regeneration harvest in which most overstory trees are removed and seedlings established. Healthy leave trees would be retained where available and desirable as defined in prescriptions, generally consisting of Douglas-fir, Engelmann spruce, limber pine, and/or whitebark pine if present. Target density is minimal (<20 sq. feet of basal area per acre) and the resulting stand even-aged. The primary species to be removed are dead/dying lodgepole pine and subalpine fir. Natural regeneration is prescribed. Stocking goals would vary by management area, and may be very open to ensure long-term fuel reduction goals are met.

b. *Improvement Cut - Chessman*: This is an intermediate treatment which removes less desirable trees in a stand of poles or larger trees to improve composition and quality. This cutting would occur in a mixed composition stand where dead and dying lodgepole pine would be removed and living trees thinned from below to create an open but stocked mature stand of healthy Douglas-fir, aspen, limber pine, and ponderosa pine. The largest, healthiest, most fire resilient trees would be retained. Residual stands would be open to ensure tree crowns do not touch, as low as 40 sq. feet of basal area per acre. No regeneration is prescribed.

3. *Fire Treatments: All cutting treatments would be followed by prescribed fire. In the fuel break areas,* fuels would generally be treated with jackpot and/or handpile burning. Some units may have substantial surface area covered by fuel jackpots. Broadcast burning would occur after harvest in the Chessman reservoir units.

a. *Slashing*: Slashing of small trees may occur as needed prior to burning. This would entail cutting small diameter trees (generally < 6" diameter) mechanically or with chainsaws. Slashing would reduce ladder fuels to lower crown fire potential and/or create sufficient surface fuels to carry a prescribed fire. Prescriptions may call for the retention of certain species and a desired spacing.

- *Underburn*: This would follow intermediate harvest. The burn would be of low severity to minimize residual tree damage and impacts to soils while reducing surface and ladder fuels. Direct and indirect mortality of leave trees would be <5%. The goals are to reduce fine woody debris (<3" diameter), reduce duff fuel loadings, expose <10% mineral soil, and retain most coarse woody debris (>3" diameter) for nutrient cycling, seedling microsites, and wildlife habitat.
- *Pile/Burn*: Hand or mechanical piling of fuels would follow slashing or harvest where slash disposal is needed but broadcast burning is not desirable. Slash would be burned when conditions are favorable after curing. Some debris may be left to meet nutrient cycling goals.
- *Jackpot Burn*: Burning focused on concentrations of natural fuels accumulations and/or slash, generally after harvest or slashing. May involve burning loose piles or areas of slash where fuels are not generally continuous and/or overstory mortality not a concern (as in a natural opening). A minimal amount of mortality may occur in nearby trees > 6" diameter.
- *Broadcast Burning*: Burning across the area to reduce hazardous fuels, including surface and ladder fuels. There would be a secondary benefit to enhancing site preparation for natural regeneration; however, because fuel reduction goals are paramount and reforestation would likely occur without burning, this treatment is not considered a site preparation burn. It is a low to moderate intensity fire where direct and indirect mortality of leave trees is <5%. The goals are to reduce fine woody debris (<3" diameter), reduce duff loading, expose <25% mineral soil, and retain sufficient coarse woody debris (>3" diameter) for nutrient cycling.

Table 4: Acres treated per Prescription

Prescription	Acres
Fuel Break Treatment	158
Clearcut with Leave Tree & Improvement Cut	332
Total	**490**

About one-half mile of temporary road, closed to public use, would be constructed for project use and then obliterated immediately after completion of the mechanical treatments. Road maintenance can be expected to facilitate hauling of trees from the project area e.g. Primary Forest Route 4009 (Lump Gulch and Corral Gulch) and the 2+ miles of the eastern portion of Forest Route 299.

Design Features

All projects that may have effects on the resources are evaluated in determining the magnitude of those potential effects and whether or not they meet certain laws, regulations or Forest Plan standards. The following design features are important in the implementation of this project and include the following:

Silviculture

- Where living residual trees are available, the healthiest, generally largest, windfirm, and most fire resistant seral species would be selected for retention at the desired distribution or spacing specified in detailed silvicultural prescriptions. No ponderosa pine would be cut.
- All competing conifers <20" dbh within and immediately adjacent to aspen clones would be cut to promote this special habitat. No aspen would be cut, although fire would be allowed to burn in suppressed clones to kill some of the overstory and stimulate suckering.
- All units will have detailed diagnoses and prescriptions prior to implementation.
- Timely regeneration following regeneration harvest is assured within 5 years. All proposed regeneration harvests would occur in dead and dying lodgepole pine stands. The success of regeneration would be monitored with stocking surveys 1, 3, and 5 growing seasons after initiation. Lodgepole pine and Douglas-fir are the desired regeneration species, with some ponderosa or whitebark pine potentially. Natural regeneration is expected due to serotinous lodgepole cones in the soil and attached to logging debris, and nearby Douglas-fir seed trees. Logging activity should provide for adequate site preparation. Stocking goals along the Flume would be 50-150 well-established trees per acre to provide for fuel break characteristics long-term. Stocking goals around the Chessman Reservoir would be 150-300 trees per acre to provide for healthy forest cover and timber production while minimizing future hazardous fuel conditions. Regeneration would be considered acceptable when it covers 70% of the area. If for an unforeseen reason natural regeneration fails, tree planting would occur with locally adapted stock.
- No 5-needled pines - whitebark (or limber if found) - would be cut. Implementation activities would strive to protect and minimize damage to any of these trees found to the extent possible. Natural regeneration of whitebark pine would be promoted due to the open nature of residual stands, and burning would further aid in its establishment. Tree planting of

whitebark is not required; however, if funding and rust resistant stock became available, consider planting whitebark in these areas.

- No snag retention is desired in fuel break areas along the Flume. In the units around Chessman Reservoir, all snags >20" dbh of species other than lodgepole pine would be retained unless they pose a specific safety or operability concern. All whitebark snags of any size would be retained around the reservoir.
- In the Chessman units, retain the isolated clumps of subalpine fir and Engelmann spruce where they occur (known to occur primarily in Unit 15 and the upper portions of Unit 10) for diversity and to provide some patches of wildlife cover. Additionally, retain the strips and clumps of young surviving trees immediately adjacent to the reservoir to provide wildlife cover (pictured Figure 8).

Wildlife

- All prescribed burns and underburning will be implemented prior to May 1 or after July 31 in order to protect nesting birds, unless surveys indicate birds are not present.
- If any listed threatened/endangered species are detected in the project area, project activities will be examined to determine if modification is necessary.
- Recommendations of from the Final Report of the *Montana Cooperative Elk-Logging Study, 1970-1985* for *Coordinating Elk and Timber Management* will be employed during timber harvest wherever they are relevant.
    - To provide elk with habitat options, logging activity would be confined to a single drainage at a time—with the exception of broad ridgetops that, while technically split down the middle between drainages, actually function as distinct habitat units. All work would be completed in the shortest time possible.
    - Logging operations would be prohibited during the first two weeks of the general rifle season in order to maintain big game habitat capability and hunting opportunity.
    - All temporary roads would be closed to public vehicles.
    - Recreational firearm use would be prohibited for anyone working in an area closed to the public.
    - Slash within clearcuts would be reduced below 1.5 feet so as not to inhibit forage development and impede movement by elk.
    - Openings would be limited to 100 acres in size so as to provide efficient foraging areas for elk and deer with hiding and screening cover available in the surrounding forest.
- If active elk calving areas are identified prior to or during project implementation, no disruptive project operations would occur in those parts of the project area from mid May through the end of June unless surveys indicate the areas are no longer being used.
- If a great gray owl nest is located in the project area, activities would be restricted within a half mile of the nest during the nesting season between March 1 and August 1.
- A buffer zone of uncut forest would be established around any active goshawk nest near treatment units. The size and configuration of this zone would depend on the location of the nest, the distribution of green overstory trees, and other local factors to be assessed by the wildlife biologist at the site. If possible, the buffer around an active nest tree should be at least 25 acres.
- No ground disturbing activities would occur inside known goshawk post-fledging areas from May 1 through August 15 to protect the goshawk pair and young from disturbance and habitat

alteration until fledglings are capable of sustained flight. Site-specific data will continue to be used and if needed, timing restrictions will be designed to reflect variations in fledging dates.

- In addition to guidelines outlined in the Hydrology and Soils reports, riparian and wetland sites will be further protected as viable wildlife habitat by retention of all healthy live trees and as many snags and as much large woody debris as practicable in and around the fringes of these sites. These sites include sub-irrigated habitats as well as those with standing water. All temporary roads would be decommissioned after the project. Decommissioning of roads would ensure no future loss of elk security or sediment movement to streams.
- In units around Chessman Reservoir, retention of about 10 tons/acre of woody debris (> 3" diameter) following treatments would provide habitat for small mammals and amphibians and ensure site productivity while meeting fuels objectives. In units around the flume, retention of woody debris would be minimized in order to meet primary fuels reduction objectives.
- Forest Plan standards for snags would be met for local 3rd order drainages by the abundance of large beetle-killed trees in untreated stands surrounding project cutting units. This will provide dead trees well in excess of the Forest Plan minimum average of 2 snags/acre in 3rd order drainages. Most snags would not be retained in treatment units because this would subvert the need to create a zone around the flume and reservoir with minimal volatile fuels.
- Whitebark pine is an important wildlife resource, and would be protected wherever it occurs within treatment units.
- Aspen would be monitored following treatment to determine if browsing by native ungulates is significantly suppressing regeneration. If survival of shoots and young trees is judged to be insufficient to regenerate healthy multi-layered aspen stands across treatment units, fencing or other means will be used to protect selected aspen clones.
- If post-treatment range/wildlife surveys indicated that cattle use in the new treatment units north and east of Chessman Reservoir were proving detrimental to riparian sites, retarding development of aspen, or displacing native grazers from the area in summer, the existing boundary fence that now runs near the east shore of Chessman Reservoir would be modified so as to block off cattle access to the new treatment units—either extending the existing fence or establishing a new fence further to the east and north.
- To maintain consistency with the Montana Cooperative Elk-Logging Study, any treatment unit larger than 100 contiguous acres would be divided into smaller subunits by a forested buffer capable of providing hiding cover for elk.

Fisheries/Hydrology/Soils

- Prescribed or pile burning would not occur inside the 50-foot stream buffer on slopes less than 35% and inside the 100-foot stream buffer on slopes greater than 35% conforming with SMZ rules for Class 1 and 2 streams.
- Avoid fire ignition within all riparian areas and stream buffers described above.
- Avoid fire line construction in all stream buffer areas described above.
- Where ground-based mechanical treatment is proposed (units 8 and 9), equipment would not be allowed within the stream buffers defined above, except when the ground is frozen or there is adequate snow as per rule 4 of the Montana SMZ.
- Where pile burning is constrained within SMZs defined above, consider chipping fuels and dispersing them.

- Mitigation measures in the National Best Management Practices for Water Quality Management on National Forest System Lands (Volume 1: National Core BMP Technical Guide—USDA, 2012) should be followed where applicable.
- Ground based operations would be conducted when soils are generally dry, or during "winter-conditions". Winter conditions are defined as ground conditions when there is a minimum of six inches frozen snow/ice and a minimum of six inches frozen soil.
- Harvesting in isolated areas determined to be wet would be avoided with all operations unless operations are conducted under "winter conditions". Operations in areas determined to be wet and contiguous to riparian areas and/or streams (not isolated) are regulated by the State of Montana SMZ laws (refer to Hydrology Report for more information).
- Log landings and slash material would be placed only in dry, upland locations rather than wet areas.
- Ground-based heavy equipment operations would be limited to slopes less than 35% gradient (USDA FOREST SERVICE 1988; BMP 13.02 and 14.07).
- Use hand-falling on slopes greater than 35% gradient (USDA FOREST SERVICE 1988; BMP 14.09).
- To sustain long-term soil nutrient cycling, retain a minimum of 5 tons per acre of coarse woody material (greater than 3-inch diameter) following treatments in warm, dry forest habitat types, and a minimum of 10 tons per acre in all other forest types (Graham et al. 1994; Brown et al. 2003).
- Conduct prescribed burning when the forest floor is moist (Harvey et al. 1994, page 43).
- Design burn prescriptions to retain adequate ground cover that would limit surface erosion rates to comply with Region 1 soil management guidelines of generally less than 2 tons per acre per year (note ground cover can include plant duff or litter, coarse woody material that is in contact with the ground, basal vegetation, and rocks greater than 2 inch diameter). At least 70-80 percent ground cover would generally be needed to prevent detrimental accelerated erosion following prescribed burning.
- Design burn prescriptions to achieve low to moderate fire intensity (USDA, 2012, Fire-1. Prescribed Fire Plan Page 54; Harvey et al. 1994, page 43).
- Following implementation of proposed vegetation treatments (including road construction and road decommissioning), sites would be monitored for noxious weed invasion, and subsequent weed treatments would be conducted to control and eradicate weeds." With this mitigation, soil cumulative effects from noxious weeds would be minimized.

Invasives / Noxious Weeds

- Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.) Reference Contract Provision C/CT6.26
- Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders (as designated by the Forest Weed Specialist). Reference Contract Provision C/CT6.261
- Revegetate bare soil as described to the Roads (3) (a), (b), (c) section.
    - (ROADS reference:(3) Re-establish vegetation on bare ground due to construction and reconstruction activity to minimize weed spread. (a) Revegetate all disturbed soil, except the travel way on surfaced roads, in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance at the site will prevent weed establishment. Use native material where appropriate and available. Use a seed mix that includes fast, early season species to provide quick, dense revegetation. To avoid

weed contaminated seed, each lot must be tested by a certified seed laboratory against the all State noxious weed lists and documentation of the seed inspection test provided. (b) Use local seeding guidelines for detailed procedures and appropriate mixes. Use native material where appropriate and available. Revegetation may include planting, seeding, fertilization, and weed-free mulching as indicated by local prescriptions. (c) Monitor and evaluate success of revegetation in relation to project plan. Repeat as indicated by local prescriptions.)

- Integrate weed prevention and management in all prescribed burning. Mitigate and reduce weed spread during prescribed fire activities.
- All crews should inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment.
- Include weed education/information in burn plan and during pre-ignition crew briefings.
- Straw used for road stabilization and erosion control will be certified weed-free or weed-seed-free.
- Temp Roads: pretreat and post treat all acres of ground disturbance with herbicide.
- Road Maintenance: Pretreat all existing infestations on roads receiving maintenance and post treat all acres of ground disturbance in the road prism.
- Units 11, 13, 14: Pretreat: Walk unit, spot treat infestations. Post treat: first growing season after unit treatments complete, walk unit, spot treat as necessary. Herbicide; no broadcast spraying from truck, only OHV with jets or backpack with hand nozzle.
- Unites 10, 15: Post treat: first growing season after unit treatments complete, walk unit, spot treat as necessary and verify inventory. Herbicide; no broadcast spraying from truck, only OHV with jets or backpack with hand nozzle.
- Unit 12: Pretreat: Walk unit, spot treat infestations. Post treat: first growing season after unit treatments complete, walk unit, spot treat as necessary. Herbicide; no broadcast spraying from truck, only OHV with jets or backpack with hand nozzle.
- Units 1, 2, 3, 4, 5, 6, 7, 8, 9: Pretreat: Walk flume units, spot treat as necessary. Postreat: first growing season after unit treatments complete, walk flume units, spot treat as necessary Herbicide; no broadcast spraying, only backpack with hand nozzle. Herbicide; no broadcast spraying, only backpack with hand nozzle.
- Monitoring: All units with existing infestation and/or all units with high risk of infestation: spring of years one, two and three (post activity) visually survey all units and treat if any noxious weeds present.
- Monitoring: Units with low/moderate risk of infestation or no existing infestation: spring of years one and three following completion of disturbance, treat any infestations found during visual survey.

Cultural Resources

- Exclude the affected cultural resource(s) from treatment unit boundaries (avoidance).
- Protect the affected cultural resource(s) through use of alternative treatment methods, such as conducting treatment during the winter, over frozen ground and snow.
- Mitigate adverse impacts to the site(s) through historical and archaeological data recovery.

Recreation

- Minimize operations during big game hunting season to reduce conflicts.
- Limit log hauling to weekdays to minimize conflicts with the public.

- Coordinate project implementation with Forest Public Affairs Officer and Law Enforcement to ensure the public is well informed of schedule and potential impacts.
- Emphasize public safety during implementation of all unit treatments.

Visuals/Scenery

To the extent feasible, the following should be considered during unit layout and implementation:

- Undulate and feather unit edges.
- Leave single trees and/or small groups of trees so they are visually connected with the unit's edges.
- Created openings and treatment units should not be symmetrical in shape.
- Straight lines and right angles should be avoided.
- Consider winter logging to minimize soil disturbance.
- During road construction, save topsoil for later use in rehabilitation.
- Where new access roads and skid trails meet a primary travel route, they should intersect at a right angle and, where feasible, curve after the junction to minimize the length of route seen from the primary travel route.
- Where feasible, retain screening trees one tree-height below roads and landings (including cable landings) when viewed from below. Avoid creating a straight edge of trees by saving clumps of trees and single trees with varied spacing.
- During temporary or permanent road construction, slash and root wads will be eliminated or removed from view in the immediate foreground to the extent possible. Slash may be aligned parallel to roads at the base of fill slopes to collect silt, but usually only if it provides this function.
- Log landings, roads, gravel pits, borrow areas, and bladed skid trails should be minimized within sensitive view sheds.
- Cut and fill banks will be sloped to accommodate natural revegetation.
- Cut and fill slopes will be revegetated with native species where ever possible.
- Ensure slash is abated near landings by scattering, chipping, or other techniques.
- In sensitive foreground areas, stumps shall be cut to 8 inches or less in height.
- Slash, root wads and other debris will be removed, burned, chipped or lopped to a height of 2 feet or less in sensitive view sheds.

Air Quality

- Prior to initiating any burning activities, a burn plan in compliance with the Montana/Idaho Airshed Group Operating Guide would be completed.
- Location, timing and possible smoke effects would be disclosed in the local newspaper and to local receptors prior to burning.
- During the burn implementation periods, the prescribed burn boss would be responsible for conducting a site specific smoke analysis with current weather and air quality conditions prior to ignition. Using that information, the burn boss would identify any effects on residents located downwind of the project burn area.
- Coordination of prescribed fire activities in other project areas would take place to ensure the amount of smoke would be manageable if multiple units across the project areas were burned.

Minerals

- Harvest equipment and prescribed fire activities should avoid sites of known mineral workings. Known mineral workings will be marked in advance of treatment by minerals personnel.

- If previously undiscovered mineral workings are found during project activities, mineral personnel will be notified.
- Unpatented mining claim corners of active claims will be protected .

Sensitive Plants

- Pinus albicaulis (whitebark pine) is known from the project area. Live individuals would be retained where they occur, and damage to these species from implementation activities would be limited to the extent possible. Please reference the Forested Vegetation report for further information pertaining to Pinus albicaulis.
- Ground reconnaissance will be conducted by the appropriate field crews in representative habitats within the project area prior to project implementation. If any other sensitive plant populations are found, those populations would be buffered and protected using design criteria as appropriate for the species.
- For species except *Juncus hallii* and *Pinus albicaulis*, an appropriate buffer would be established by the botanist where no ground disturbance or herbicide application would occur. For *Juncus hallii* populations, ground disturbance would be avoided. Broadleaf herbicide application would not be restricted as this species is not affected by those herbicides.
- Maps of known Sensitive Plant populations within the project area would be reviewed prior to each implementation season.

ALTERNATIVES CONSIDERED BUT DISMISSED

Scoping is an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action (40 CFR 1501.7). This process aids the decision-maker, in part, on whether there are unresolved issues or if there are alternatives considered but eliminated from detail analysis.

The Flume Chessman Project scoping process utilized mailings, open houses, news articles, and the Helena website to involve interested publics. Results from the scoping revealed that there are no unresolved conflicts concerning alternative uses of available resources. Agency regulation 36 CFR 220.7(2)(i) states that if there are no unresolved conflicts, then the agency need only to analyze the proposal and proceed without consideration of additional topics. The following were considered but eliminated from detailed analysis.

1. *Include treatment for all components of the city of Helena's water delivery infrastructure.* **Rationale:** The Flume Chessman Project only addresses the Red Mountain Flume and Chessman Reservoir, the remaining water delivery infrastructure was not considered in detail for the following reasons:
    a. Scott Reservoir and the adjacent lands are owned by the city of Helena and are currently under planning efforts for vegetation treatment by the city of Helena.
    b. Headgates located on Tenmile Creek, Beaver Creek, and Walker Creek are located on mixed ownership of private and city lands. Fuel mitigation has been completed on Walker Creek Headgate and is ongoing for Tenmile Creek & Beaver Creek Headgates.

c. Headgates located on Minnehaha Creek and Moose Creek are on federal lands, vegetation adjacent to these infrastructures have been treated under the Forest-wide Roadside Hazard Tree Removal and Fuels Reduction Project (2010) and Rimini County Road Hazardous Tree Removal Project (2011). Treatments started in the summer of 2011 and are currently ongoing.
d. City cabin site is incorporated in this proposal in Unit 1.

Therefore, all water delivery infrastructures that are located on federal lands are currently included in the proposal or being treated under another decision including the city of Helena and the Forest Service.

2. *Construction of Flume with Alternate Material.*
Rationale: In February 2010, the city of Helena commissioned a study though Hydrometrics, Inc., an engineering and scientific consulting firm to assess the Red Mountain Flume. One of the facets of the study was to analyze the cost, impact and effectiveness of an enclosed pipe as well as other potentially viable options including vegetation removal along the flume corridor. The firm analyzed the feasibility of different alternatives to the current infrastructure in order to reduce or minimize the harmful effects of wildfire. Different varieties of pipe were evaluated including cement, several types of plastic, corrugated metal and smooth steel. Even though moving to an enclosed piping system would be more efficient for the water system and would be less costly to maintain, currently the funds to implement such a system are not available.

3. *Agency can meet project goals without logging.*
Rationale: Currently, the treatment units are composed primarily from mature beetle killed lodgepole pine which limits the types of slash disposal methods available to meet project objectives. With the goal of removing the majority of the dead trees and fuel loads around the existing infrastructure, trees must be either mechanically cut and removed with logging equipment, or hand felled and piled, followed by burning.

Treating the 432 acres proposed for mechanical treatment by hand felling followed by piling and burning would result in an increased cost per acre. Mechanized logging equipment allows for efficiencies in treatment production rates when working in dense mature forested stands. The safety risk for the workers would be greater with no logging equipment being used due to the hand fallers being exposed to risks of working in dense stands of dead trees. Without logging and tree removal, all trees and fuels needed to be removed to meet project objectives would be piled and those piles burned within the units. The burn piles would be much larger and would result in a larger proportion of the treatment units and the soils resource being exposed to high severity fire effects.

Therefore, a 'no logging' options would be undesirable from a human safety perspective, economically inefficient, and would result in a larger proportion of the treatment units and the soil resource being exposed to high severity fire effects.

4. *Implementation delay between the east and west side of Chessman Reservoir to allow shrubs to grow into effective cover for wildlife.*
   Rationale: Treatment areas near the Chessman Reservoir are dominated by mature lodgepole pine trees and are currently >90% dead. Many of the dead trees are still standing but are expected to fall in 3-15 years after death. The ability of equipment to remove material is greatest when trees are standing due to the physical constraints of operating in "jack-straw" fuels. Further, the value of trees declines once they have fallen, reducing economic viability as fallen trees deteriorate. In addition, in the relatively short-term fallen trees would not provide effective cover for long whether treatment occurs or not.

   After removal or natural fall of dead trees, shrub response is not expected near the reservoir because the habitat types affected do not support tall shrubs. Rather, undergrowth near the reservoir would be dominated by grasses and forbs. These species are not expected to provide effective wildlife cover.

   Therefore, delaying treatment on one side of the reservoir to allow shrubs to grow into wildlife cover is not feasible to consider in detail because 1) substantial snag fall is imminent, which causes a time sensitive need to efficiently remove them, and would result in a loss of standing tree cover regardless of alternative, 2) there is a lack of potential for tall shrub growth on the affected habitat types, and 3) to the extent feasible, the proposal already includes design criteria in place that maximize the potential for retention of cover.

5. Alternative methods for preventing sediment build up in Chessman Reservoir.
   Rationale: The purpose of this project is to be responsive to the immediate hazards surrounding the flume and reservoir. This project is a small piece of the larger landscape-scale evaluation being considered for the Upper Tenmile Watershed. In that evaluation, options will be assessed regarding the overall resource conditions and possible landscape needs of the greater Tenmile Watershed.

   If reduction of fuels in forest stands around the reservoir is not implemented and a wildfire were to occur, then a vigorous response would be initiated under the Burned Area Emergency Response (BAER) program in order to try to protect the flume and reservoir from potential post-fire sedimentation. Treatments would probably include widespread hill-slope stabilization and sediment traps. Cost for BAER treatments of this magnitude would be considerable—for example, helicopter application of agricultural straw or wood straw mulch would likely be prescribed at costs of roughly $1000-$3000 per acre.

6. *Create a fuel break set back from the reservoir so cover can be retained near the reservoir.*

Rationale: The purpose of this project is to reduce the risk of damage to the flume and reduce risk of high-severity wildfire effects near the reservoir resulting in less sedimentation and ash deposition into the reservoir. This project proposes to remove dead/dying trees to accomplish that goal. Windthrow of beetle-killed snags will greatly increase coarse surface fuel loads and the severity of potential wildfires burning in untreated stands (Andrews et al., 2011; Brown, 1975; Kulakowski and Veblen, 2007). Studies have found a consistent increase in surface fire intensity (fireline intensity and rate of surface fire spread) in 0-5 years post-outbreak forest stands (caused by a pulse of surface fine fuels from dead trees) and in 5-60 years post-outbreak forest stands (caused by an increase in wind speed in the more open stands) (Page and Jenkins 2007a, 2007b; Jenkins et al. 2008).

Figure 2: Representative mountain pine beetle mortality within forest stands near Chessman Reservoir.

If the agency were to only treat a strip (fuel break treatment) set back from Chessman Reservoir we would still have a high fuel loading adjacent to Chessman in the untreated area, which could become a receptive fuel bed for embers in the event of a wildfire. These untreated stands immediately adjacent to Chessman would create areas more likely to burn with high severity, which could provide transport areas of ash and sediment to the reservoir.

Surface fuel management can limit fireline intensity (Byram, 1959) and lower potential fire severity (Ryan and Noste, 1985). Therefore, leaving untreated fuels adjacent to Chessman Reservoir would not meet the purpose and need of this project.

ENVIRONMENTAL EFFECTS

This section summarizes the potential impacts of the proposal for each affected resource. This environmental document briefly provides sufficient evidence and analysis to determine whether to prepare either an EIS or FONSI, discloses the environmental effects if any adaptive management adjustments are used, describes the impacts of the proposal in terms of context and intensity, and discusses direct, indirect, and cumulative impacts. Further details and conclusion about the potential effects are available in reports for each resource and other supporting documentation cited in those reports. This document hereby incorporates by reference the project record (40 CFR 1502.21). The supporting document within the project record includes the detailed data, methodology analyses, assumptions, conclusions, maps, references, and technical documentation used to complete this document. This document and assorted specialist reports are also available on the Helena webpage at www.fs.usda.gov/helena/.

Fuels/Fire

Fire suppression efforts in this century have had the effect of decreasing acreage burned in normal fire season, reducing the natural variability in landscape patterns that would otherwise be created by small fires (USDA, 1990). As a result, the larger, contiguous blocks of uniform stands are subject to large mountain pine beetle (MPB) outbreaks and catastrophic fires when fire weather is extreme (USDA 1990). The project area and the greater watershed are currently experiencing these conditions. Stands in the project area are predominately lodgepole pine dominated and are currently >90% dead due to recent MPB outbreak (Milburn, Vegetation Report, 2013).

A fire behavior model called Behave Plus along with professional knowledge and experience was used to compare pre-treatment and post-treatment fire behavior for the proposed treatment units. See more detail and assumptions of the model in the Fire and Fuels Specialist Report (Thompson, 2013) filed in the project record. Outputs from this model include surface rate of spread, flame length, heat per unit area (Btu/ft20, and fireline intensity.

Another model referred to as FOFEM was also used, which projects tree morality, fuel consumption, smoke production, and soil heating caused by prescribed fire or wildfire.

The following Fuel Models (Rothermel's Surface Fire Spread Models) were analyzed in this report.

- **GR2 (102) – Low Load, Dry Climate Grass:**
  The primary carrier of fire is grass, though small amounts of fine dead fuel may be present. Load is greater than GR1, and fuelbed may be more continuous. Shrubs, if present, do not affect fire behavior. The fine fuel load is 1.10 tons per acres.
- **TU1 (161) – Low Load, Dry Climate Timber-Grass-Shrub:**
  The primary carrier of fire is low load of grass and/or shrub with litter. Spread rate is low; flame length is low. The fine fuel load is 1.3 tons per acres.
- **TL1 (181) – Low Load, Compact Conifer Litter:**

The primary carrier of fire is compact forest litter. Light to moderate load, fuels 1 to 2 inches deep. May be used to represent a recently burned forest. Spread rate is very low; flame length very low.

- **TL3 (183) – Moderate Load Conifer Litter:**
  The primary carrier of fire is moderate load conifer litter, light load of coarse fuels. Spread rate is low; flame length low.
- **TL4 (184) – Small downed logs:**
  The primary carrier of fire is moderate load of fine litter and coarse fuels. Includes small diameter down logs. Spread rate is low; flame length low.
- **TL5 (185) – High Load Conifer Litter:**
  The primary carrier of fire is high load conifer litter; light slash or mortality fuel. Spread rate is low; flame length is low.

Effects Common to both No-Action and Proposal

Wildland fire behavior in treated as well as untreated areas depends on the fuels in addition to topography and weather. Given the current condition the dynamics associated with lodgepole pine mortality, untreated areas can be expected to realize higher intensity fires that consume a considerable portion of duff and litter due to current density, stand structure, red needled litter, and stand composition (Agee and Skinner 2005; Graham et al. 2004).

Within the project area, but outside the treatment units, fuels will continue to accumulate as discussed below in the No-Action Alternative. Currently standing dead will begin to fall and add to the fuels on the forest floor.

This area is currently listed as a Fire Management Unit (FMU) 1 within the Helena National Forest Fire Management Plan. The standard suppression method in a FMU1 calls for rapid aggressive methods. The suppression methods and management of this area will not change with either alternative. Rapid response as well as aggressive suppression strategies will continue in both the short and long term.

No Action

Effects to Fuels

Currently the fuel model for units 1 – 5 and 11 - 15 are classified as a TL3 (183). Units 6 - 10 are classified as a TU1 (161) fuel model. All units have been heavily affected by the MPB. The majority of the treatment units have progressed into the “gray stage” and are beginning to transition into the initial stages of deterioration. As the dead timber begins to fall there would be a change in the fuel modeling within all the units. Units 1 – 5 and 11 - 15 would move from a TL3 (183) fuel model to a TL5 (185). Units 6 - 10 would move from a TU1 (161) fuel model to a TL4 (184). The reduction in fine fuels would result from an increase in large diameter timber (3+ inches) on the forest floor. These large diameter fuel loads would persist in the units for the foreseeable future, until they slowly deteriorate or are altered by wildfire or other disturbances. New regeneration caused by an open canopy would add to an increase surface fuel bed, over the long-term. The combination of regeneration with fallen large diameter fuels would change the fire effects.

Figure 3: Example of Downed Fuel Buildup in Lodgepole Stand killed by MPB

Figure 4: Example of Fuel and Regeneration Condition in the Longer Term

Effects to Fire

BehavePlus modeling results show that the increase in large diameter fallen fuels would result in an increase in fire behavior regarding surface rate of spread, fireline intensity and heat per unit area. Flame lengths would double and fireline intensities would more than triple. Below are the modeling results from BehavePlus and FOFEM describing the short-term changing fire effects caused by the change in listed above in the Effects to Fuels:

Table 5: BehavePlus Modeling Outputs

No Action Alternative Fire Effects				
Fuel Model Type	Surface	Heat Per Unit	Fireline	Flame

	Rate of Spread	Area (Btu/ft2)	Intensity (Btu/ft/s)	Length
TL3 (Current condition)	2.3 ch/h	191 (BTU/ft2)	8 (Btu/ft/s)	1.2 ft
TL5 (Expected condition once snags have fallen)	5.8 ch/h	334 (Btu/ft2)	35 (Btu/ft/s)	2.3 ft
TU1 (Current condition)	0.9 ch/h	127 (Btu/ft2)	2 (Btu/ft/s)	0.6 ft
TL4 (Expected condition once snags have fallen)	3.2 ch/h	230 (Btu/ft2)	14 (Btu/ft/s)	1.5 ft

Figure 5: FOFEM modeling outputs for fire intensity, with current fuel model condition.

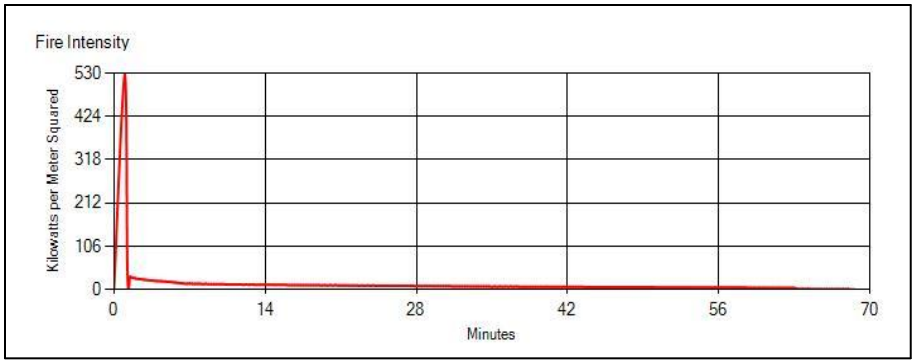
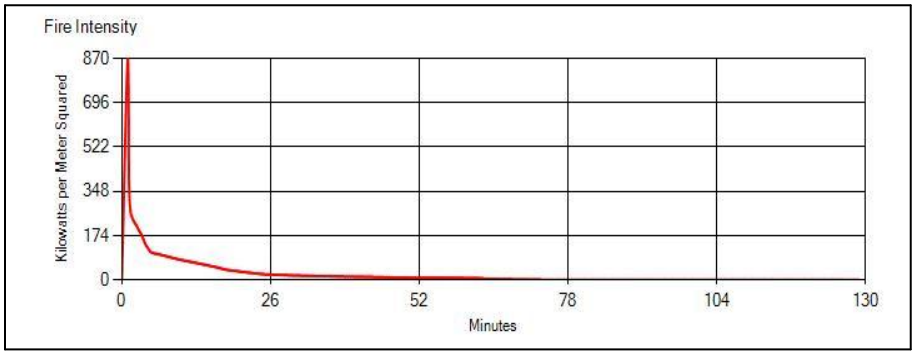


Figure 6: FOFEM modeling output for fire intensity. Modeled as future fuel model condition under a " No Action Alternative".



Under the no-action alternative, no treatments would occur within the project area, and would allow for natural processes to continue. The standing dead lodgepole brought about from the MPB outbreak would continue to fall adding to the accumulation of coarse woody debris already on the ground. Without a disturbance such as wildfire or other treatment project, this fuel load would remain for the foreseeable future until it deteriorates. The potential for wildfires on the landscape would remain, and current suppression actions would continue. The potential for high severity wildfire in the surrounding landscape and within the project area would remain. Should a wildfire burn within the project area,

potential direct and indirect fire effects to both the flume and chessman reservoir would remain and increase with accumulation of dead material.

Proposal

The proposed treatments are designed to promote healthy forests while minimizing hazardous fuel conditions in the short- and long-term.

Table 6: Proposed Action Treatments

Prescription	Acres
Clearcut with Leave Trees, Broadcast Burn	317
Improvement Cut, Underburn	15
Fuel Break Treatment	158
Total	490

Table 7: Proposed Action Treatment Method

Treatment Type	Treatment Method	Acres
Harvest or Fuels	Ground Based Mechanical	432
Fuels	Hand Treatment	58

In addition to the proposed treatments, the proposal would also consider the re-issuance and modification of the special use permit for the city of Helena to conduct maintenance treatments on the right-of-way for the flume. The right-of-way would be increased from 15' (7.5' either side of the Flume) to 200' (100' on each side of the Flume). The maintenance specifications would also be expanded to describe the desired condition as a shaded fuel break consistent with the current proposed treatments.

Effects to Fuels

Within project units 1 – 5 the proposal would alter the current fuel condition of a TL3 (183) fuel model to a GR2 (102). The use of mechanical or hand treatments to remove the standing dead and/or thinning of the live trees would decrease the canopy cover and reduce large diameter (>3 inches) fuel loadings within the units. This in turn would promote the growth of grass adding to a larger fine fuel loading. Pile burning would be used to reduce residual woody debris. Jackpot burning in these units would allow for some residual small and large diameter woody debris to remain on the ground.

The areas within project units 6 – 10 would move from a TU1 (161) fuel model, to a TL1 (181). There would be a decrease in the large diameter fuels (>3 inches) by removing dead or dying timber and increasing the canopy spacing between healthy trees that would be left. The use of jackpot burning along with pile burning would decrease the residual fuel loadings within these units while maintaining some small and large diameter fuels. Unit 10 would utilize broadcast burning to reduce both large and small diameter woody debris, as well as reduce the fine fuels.

The project units 11 – 15 would move from a TL3 (183) fuel model to a TL1 (181). The increase in fine fuel loading would be reduced through understory burning and pile burning. Large diameter timber would be reduced similar to units 6 – 10.

Figure 7: This picture displays the reults of similar treatments in the nearby Clancy Unionville project.

Untreated areas within the project boundary would remain as discussed in the No Action Alternative. Having treated areas within the project boundary would help reduce large fire growth within the project area.

Effects to Fire

The reduction in large diameter fuels but potential increase in fine fuels would have an effect on fire behavior. There would be a reduction in flame length, fireline intensity, rate of spread, and heat per unit area. Below are the modeling results in BehavePlus 5.0 describing the changing effects listed above in the Effects to Fuels:

Table 8: BehavePlus modeling outputs

Action Alternative Fire Effects				
Fuel Model Type	Surface Rate of Spread	Heat Per Unit Area (Btu/ft2)	Fireline Intensity (Btu/ft/s)	Flame Length
TL3 (Current condition)	2.3 ch/h	191 (BTU/ft2)	8 (Btu/ft/s)	1.2 ft
GR2 (Expected condition post treatment)	2.2 ch/h	63 (Btu/ft2)	3 (Btu/ft/s)	0.7 ft
TU1 (Current condition)	0.9 ch/h	127 (Btu/ft2)	2 (Btu/ft/s)	0.6 ft
TL1 (Expected condition post treatment)	0.8 ch/h	100 (Btu/ft2)	1 (Btu/ft/s)	0.5 ft

TL3 (Current condition)	2.3 ch/h	191 (BTU/ft2)	8 (Btu/ft/s)	1.2 ft
TL1 (Expected condition post treatment)	0.8 ch/h	100 (Btu/ft2)	1 (Btu/ft/s)	0.5 ft

The reduction in Surface Rate of Spread as well as Flame Length would help in reducing the potential of direct flame impingement upon the flume structure. The reduction in Heat Per Unit Area and Fireline Intensity would decrease direct fire effects to the soils.

Figure 8: FOFEM modeling output for fire intensity, with current fuel model condition

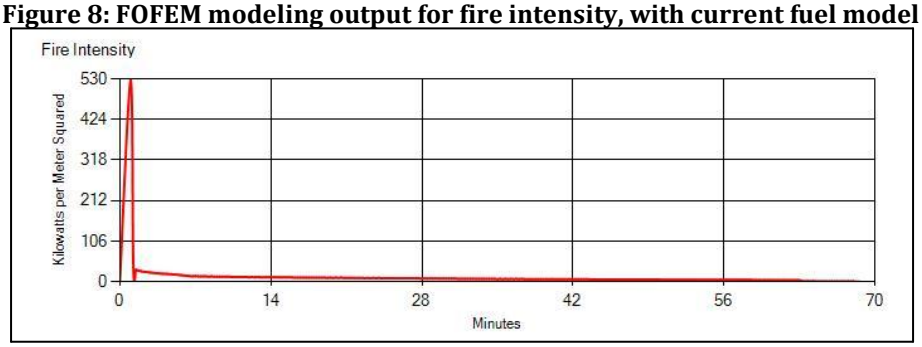
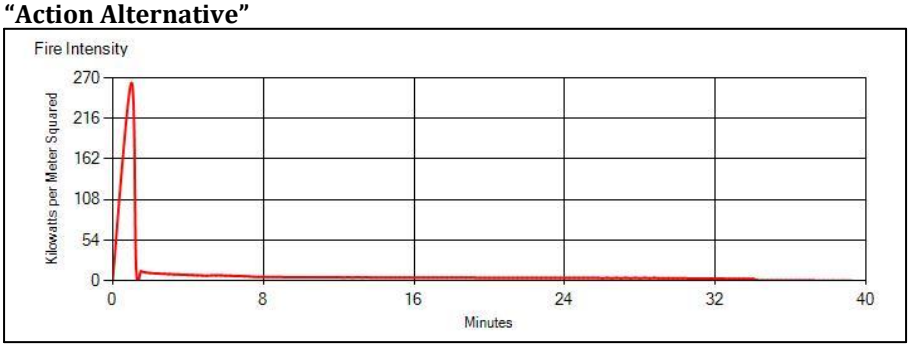


Figure 9: FOFEM modeling output for fire intensity. Modeled as future fuel model condition with "Action Alternative"



Over the long-term in Units 1-9, portions of these units along the flume would be maintained with lower fuel loadings through the special-use permit with the city of Helena. There may be the potential for some regeneration along the flume, but an increased maintenance area would control the amount of regeneration (refer to the Forested Vegetation Report). This continued maintenance would help reduce the potential for direct flame impingement on the flume structure. It would also reduce the potential for damage to the flume from falling timber. A continued reduction in flame length, surface rate of spread, heat per unit area, and fireline intensity can be expected with a maintained reduction of fuel loading.

In Units 10-15, natural regeneration would occur within these units, with the expectation of a future pre-commercial thinning to maintain an open condition resistant to high severity crown fire. Fuel loadings within these units would remain lower than current conditions and continue at levels similar to those discussed in the short-term fuel effects. Surface fuel management can limit fireline intensity

(Byram, 1959) and lower potential fire severity (Ryan and Noste, 1985). Fire behavior would potentially increase in the initial stages of regeneration due to increased grasses and low lying regeneration, but fireline intensities and heat per unit area would remain low without the accumulation of coarse woody debris on the forest floor. As the regenerating trees mature, the fire behavior would likely subside as the potential for a low intensity surface fire would increase. The reduction in canopy continuity in the mature trees would help in reducing the potential for a high severity crown fire, over the long-term.

Under the proposal, the removal of the standing dead timber and reduction of existing surface fuels within the project units would reduce the future fuel loading. Both the reduction of fuel loadings by mechanical and hand treatments, in coordination with prescribed fire burning would help in reducing potential direct wildfire effects within treated areas. A reduction of flame length, fireline intensity, and heat per unit area would occur in treated areas, and following treatment, indirect fire effects to both the flume and chessman reservoir would also be reduced. Fire at the landscape level would remain relatively unchanged and similar to the No-Action.

Cumulative Effects

Cumulative effects are the incremental environmental impacts of this action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. In the Fire and Fuels Specialist Report (Thompson 2013) filed in the project record, Table 8 reflects those effects on projects as far back as the 1960s. Consideration was given to timber harvest, fuels activities, grazing, routine use and maintenance of trails and Forest System roads, noxious weed treatments, firewood & post/pole permits, etc. to evaluate if cumulatively there may be concern to the fire and fuels resource.

Evaluating those cumulative effects described on Table 8 in the specialist report and this proposal would see fuel loading reductions along the flume and around the reservoir but conditions on the landscape level would still be at risk to a severe wildfire event. However looking at all of these past, ongoing and future activities coupled with this proposal, there would be no significant impacts individually or collectively taking place over time.

Forest Plan Consistency

The treatment of the project units meets the Helena National Forest Plan directive for fire and fuels. See the Forest Plan Consistency Table in Appendix B of this document.

Specifically,

- Prescribed fire would be utilized as a means to reduce the potential of a damaging wildfire.
- Burning would fall under the natural fire regime cycle for the project area.
- Prescribed fire meets management directives by reducing natural fuels, enhancing and maintaining resources, reducing slash, and enhancing silvicultural objectives.
- Continue active suppression of wildfires would meet the fire management objectives for this area.
- A combination of mechanical treatment with jackpot or pile burning would meet management directives for fuels reduction.

Hydrology

The Red Mountain Flume and Chessman Reservoir are critical elements of the city of Helena's municipal watershed infrastructure. Current vegetation conditions in the area around the flume and reservoir pose an elevated risk of high-severity impacts to soil in the event of a wildfire. Such impacts would lead to a post-fire runoff response that could damage the flume and deposit sediment and ash in the flume and reservoir. This scenario would severely constrain the city of Helena's ability to provide water from the Tenmile treatment plant—the primary source of drinking water for the city. Maintaining the viability of the Tenmile Creek municipal watershed is a HNF Forest Plan requirement. While the proposed treatments themselves pose a risk of sediment delivery to the flume and reservoir, resource protection measures would minimize this potential, and substantially reduce the probability of high-severity impacts from a wildfire.

No-Action

Under the no-action, no new management actions are proposed. If no new actions are undertaken, no new management-related water resource impacts would occur. Past and ongoing management activities, such as road use, OHV use, mining, and livestock grazing would continue to affect water resources. No new additions to watershed-scale cumulative effects would be predicted, because no new management activities are proposed with no-action. However, the probability of a high severity wildfire in the drainage with its attendant watershed effects would be higher in this alternative than in the action alternative—a potential indirect effect.

Numerous studies have documented post-wildfire increases in erosion and stream sediment levels (e.g. Wagenbrenner et al., 2006; Spigel & Robichaud, 2007; Robichaud et al., 2008; Moody & Martin, 2009). Recent studies of the effects of wildfire on municipal water supply have identified increases in nitrates, phosphorous, dissolved organic carbon, turbidity, total suspended solids, and metals in streams draining areas affected by wildfire (Emelko et al., 2011; Rhoades et al., 2011; Writer et al., 2012). Elevation of concentrations of some nitrogen compounds in source water can result in higher water treatment costs and other impacts to municipal water quality (Emelko, et al., 2011). The effects of a wildfire on source-water quality can be long-lasting—in the Rocky Mountains of Alberta, post-fire water quality degradation persisted throughout a ten-year analysis period following the fire (Emelko et al., 2011). A USGS assessment of a municipal drainage in Colorado found that poor water quality following the Fourmile Canyon Fire periodically exceeded the treatment capacity of municipal facilities (Writer & Murphy, 2012). Additionally, elevated sediment and nutrient deposition in reservoirs can reduce reservoir capacity and impact water quality.

Non-fire disturbances of forested lands (e.g. timber harvest) have also been shown to affect soil nutrient availability as well as concentrations in stream water draining harvested areas due to a variety of complex mechanisms (e.g. Gravelle et al. 2009; Feller, 2005; Vitousek & Melillo, 1979). Generally, lower-severity fire has been shown to have a smaller (if any) increase in nitrogen availability than does intensive timber harvest, and higher-severity fire has generally resulted in greater increases in nitrogen loads in streams than harvest alone or with lower-severity prescribed fire (Stephan et al., 2011; Ranalli, 2004; Williams & Melack, 1997; Brass et al., 1996; Mackay & Robinson, 1987; Bayley et al., 1992).

While it is difficult to anticipate the exact pattern of burn severity to soils from either a prescribed fire or a wildfire in the project area, some general conclusions can be made from the fire-effects literature as well as monitoring of prescribed fire on the Helena NF (for details of HNF monitoring, see Soils Specialist Report). Whereas a wildfire typically burns through a landscape when conditions are hot and dry, prescribed fires are usually implemented when soil, duff, and coarse woody debris moisture levels are relatively high (i.e. in the spring and late fall). Burning that occurs during conditions of higher soil moisture generally results in lower impacts to soils (Hartford & Frandsen, 1992; Stephan et al., 2012; Stoof et al., 2013). Stephan et al. (2012) found that wildfire-burned drainages exhibited higher severity effects than drainages burned in springtime prescribed fires, and produced substantially greater impacts to water quality. Furthermore, Rhoades et al. (2011) found that post-fire impacts to water quality in and around the Denver municipal watershed were closely correlated to burn severity and extent—the larger the area with high-severity burn effects, the greater the impact to stream water quality during the five-year analysis period following the Hayman Fire in 2002.

In order to estimate the differences between the impacts of low-severity and high-severity fires, treatment units were evaluated using the ERMiT model. Results suggest that a fire with high-severity effects to soils across all of the Chessman treatment units would result in erosion rates roughly 450% of those resulting from a fire with low-severity effects (Table 1). The modeling results support findings in the literature and suggest that prescribed fire that produces primarily low-severity impacts to soils will result in substantially less erosion and attendant water quality effects than would a wildfire with moderate-to-high severity impacts.

The project area lies within a fire-prone landscape, and wildfires and associated watershed effects are likely under any of the alternatives. However, analysis and modeling of current conditions suggests that there would be an increased risk of a severe wildfire absent the management actions proposed under the proposal (see Fuels Specialist Report). In the project area, the potential for widespread post-fire sediment and ash delivery to the reservoir and flume are a serious concern, as such a response would likely force the City Water Department to stop water withdrawals from this portion of the municipal watershed for an extended period of time. Chessman Reservoir outflow accounts for roughly 20-25% of the input to the Tenmile Treatment Plant in a wetter years, and up to roughly 75% in dry years (Jason Fladland, pers. comm., 2013).

Table 9: Predicted erosion rate from Chessman units in first year following fire for three different burn severity scenarios (20% exceedance value from ERMiT).

Unit	Predicted post-fire unit erosion rate (tons/acre)			Predicted post-fire unit sediment yield (tons)		
	Low-severity	Moderate-severity	High-severity	Low-severity	Moderate-severity	High-severity
10	0.63	1.13	3.02	32.8	58.8	157.0
11	0.11	0.20	0.73	3.4	6.2	22.6
12	0.85	1.03	3.77	12.8	15.5	56.6
13	0.52	0.89	1.16	12.5	21.4	27.8
14 UT*	0.37	0.62	1.59	42.9	71.9	184.4
14 LG*	0.68	1.07	2.81	21.1	33.2	87.1
15	0.61	1.22	3.27	34.8	69.5	186.4
Total				160.2	276.4	722.0

* portion of unit 14 in the Upper Tenmile drainage vs. the Lump Gulch drainage

The no-action alternative would comply with all federal and state laws and regulations in that no specific management activity related to hazardous fuels mitigation would occur in the project area. However, this alternative may be in conflict with HNF Forest Plan general watershed standard #8, which requires municipal water supply infrastructure to be maintained in a "safe and serviceable condition" (USDA FS, 1986 p II/26). Widespread tree mortality has left the flume and potentially Chessman Reservoir vulnerable to a wildfire of high severity, along with attendant watershed effects, which threaten the viability of this part of the municipal watershed. While the city of Helena has implemented recent projects on private and city lands along the flume to protect the structure, the City's current Special Use Permit (SUP) with the Forest Service does not allow for maintenance work beyond a few feet of the flume, or in the area around the reservoir. The City has requested that the Helena NF treat areas along the flume within the National Forest—this project is an effort to comply with the City's requests and to meet the intent of the Forest Plan standard.

Proposal

In the proposed project, removal and yarding trees using mechanized equipment as well as prescribed fire would most likely temporarily expose mineral soil to erosion, and may create new (or exacerbate existing) vectors for sediment transport to stream channels. Project activities could expose sediment to overland flow in harvest areas, on skid trails and landings, at ditch crossings, and on haul-route roads. Project resource protection measures could greatly reduce the probability that any eroded sediment would reach the flume or reservoir.

The intent of prescribed fire is to consume fuels in a controlled manner, in conditions that would minimize impact to the soil, and thus minimize potential for widespread erosion and sediment transport to water bodies. The proposed activities would include a mix of broadcast and pile burning. Although pile burning often results in small areas of higher-severity impacts to soils, the pile sites are typically surrounded by relatively undisturbed forest floor, which minimizes soil erosion and prevents the transport of any eroded sediment. Where broadcast burning is the preferred method of slash removal, efforts should be (and generally are) made to minimize impacts to soil. The Soils Report for this project

describes potential soils impacts and resource protection measures in detail. In addition to the protections outlined in the Soils Report, a no-ignition buffer should be implemented around all bodies of water in units with a broadcast burn prescription. The WEPP hillslope module was used to estimate appropriate no-ignition buffers for all treatment units that are adjacent to water, including wetlands. Model results suggest that a 100-foot no ignition buffer should prevent sediment transport from treatment units to bodies of water—this value is in line with the more restrictive buffer width listed in Montana SMZ law. For units with pile burning, a setback of fifty feet should be maintained from any body of water.

Harvest and skidding operations in some of the units along the flume could also potentially expose soil to erosion. Proper application of forestry BMPs (Logan, 2001) should minimize erosion from treatment areas (see Soils Report). Where erosion from a treatment unit occurs, buffers would most likely prevent transport across untreated forest floor of eroded sediment from treatment areas or landings directly to streams or Chessman Reservoir (Ice et al., 2004; Montana DNRC, 2012). Maintaining a skid-trail set-back of 50 feet from the flume and tributaries (except at crossings—see discussion below) and complete rehabilitation of skid trails and other incidental disturbance should prevent erosion and sediment transport in these areas during and after project activities.

Crossings of the flume and a tributary to Beaver Creek (the first tributary downstream from the reservoir, SE ¼ of section 2) by logging equipment could potentially occur in order to minimize skidding distances and disturbance. Unlike the flume, the streams that cross the flume are covered by the SMZ law as type-2 channels. Thus, in order to cross the tributary, an alternative practice would be required. The tributary where the potential crossing would occur is diverted entirely into the flume. There is a gate on the flume that can allow flow to be diverted back into the channel, although in practice it is generally closed. Thus, the channel downstream of the flume is narrow and shallow, and generally dry by mid-summer. The crossing should be managed so that no damage occurs to the bed or banks of the channel, and so that sediment delivery is minimized—various means of accomplishing this would be feasible. If anything is placed in the channel to accomplish the crossing (e.g. logs, matting), a SPA 124 permit would be required, as well as potentially a Montana 318 permit. Crossings of the flume would be minimized and occur at locations with relatively low-gradient approaches. At these crossing locations, the ditch should be dewatered using gate structures at upstream locations. Crossings should be done in a manner that prevents disturbance of the bed and banks of the ditch (e.g. by placing logs in the ditch and brush or tire mat on approaches).

Haul roads are a likely source of sediment to project area streams, particularly where there are existing sediment delivery points. Increased heavy-truck traffic related to log hauling can increase rutting and displacement of road-bed material, creating conditions conducive to higher sediment delivery rates (Reid & Dunne, 1984). A ford of Beaver Creek on an existing road (299-H1) would also be required in order to haul logs from units 4 and 6. Project-related use of the ford also has the potential to temporarily increase sediment delivery to the stream.

Application of road maintenance and hauling BMPs (e.g. blading/compaction, drainage improvement, aggregate surfacing) can substantially reduce erosion and sediment transport along haul routes (Ice et

al., 2004; Montana DNRC, 2012). For example, well-designed and maintained road surface drainage, in conjunction with a properly graded road surface, should divert most road-surface runoff to undisturbed forest floor, where conditions allow for sediment deposition and infiltration (Burroughs & King, 1989; Foltz & Burroughs, 1990; Montana DNRC, 2012). At crossings and other areas where proper road drainage cannot prevent overland flow to a stream, gravel surfacing using high-quality aggregate will minimize sediment transport and delivery (Kochenderfer & Helvey, 1987; Burroughs & King, 1989; Sugden & Woods, 2007). The ford on road 299-H1 would require hardening of the approaches with aggregate in order to prevent rutting and minimize erosion. Additionally, properly applied log-hauling BMPs should limit any increase in sediment delivery from roads.

The proposed project would require that all log-haul roads with surveyed sediment-delivery points be improved to reduce delivery prior to commencement of tree removal and hauling. A list of site-specific resource protection measures for haul routes is listed in Appendix A. Sediment delivery points were modeled using the WEPP roads module (Elliott, 2000) in order to estimate existing conditions as well as potential reductions in sediment delivery resulting from project road improvements. Results indicate that project road work would result in a decrease in sediment delivery by roughly 90% on an annual average basis (Table 2). This reduction helps the HNF road network in the Upper Tenmile and Lump Gulch drainages meet the Lake Helena TMDL sediment load reduction goal of 60% for unpaved roads (US EPA, 2006). The model evaluated existing (rutted, native surface with existing often inadequate drainage) conditions and post-improvement (unrutted with improved/adequate drainage) conditions. One segment of road was also modeled with aggregate surfacing, where currently there is native surfacing. Additionally, while the proposed road BMP work would reduce sediment delivery from project roads during project activities and into the future, blading of native-surface roads temporarily exposes higher levels of sediment to erosion and transport (Sugden & Woods, 2007). Compaction of freshly bladed surfaces prior to rainfall, whether by a roller or by traffic, reduces this temporary road surface susceptibility to erosion. While the evaluated road improvements would substantially reduce erosion and sediment transport on project haul roads, conditions likely would return gradually to pre-treatment conditions over a period of 5-7 years without continued maintenance.

The culvert on road 299 on the north end of the reservoir at the boundary of units 11 and 12 was identified to be in need of replacement. Other stream culverts on haul routes were determined to be of adequate size and conditions. Several partially plugged ditch-relief culverts were identified on road 4099—these culverts would need maintenance in conjunction with other haul-route road improvements.

Table 10: Estimated sediment delivery by haul-route road before and after project improvement work.

Road	Sediment delivery (tons/year)		Project improvements
	Existing	Project	
4009	4.89	0.36	Blading, compaction, drainage improvement*
299 *UT***	1.59	0.44	Blading, compaction, drainage improvement
299 *LG***	0.27	0.04	Blading, compaction, drainage improvement, spot gravel
299-E1	0.61	0.01	Blading, drainage improvement
299-H1	2.85	0.04	Blading, drainage improvement
Total	10.21	0.89	

* drainage improvements generally consist of re-installing rolling dips at proper intervals and clearing or replacement of ditch-relief culverts—both in locations where drainage will flow to undisturbed forest floor.
** portion of road 299 in the Upper Tenmile drainage vs. the Lump Gulch drainage

It is unlikely that the proposed activities would lead to increased stream bank erosion, as equipment will generally not operate near stream channels. An exception is the aforementioned tributary to Beaver Creek, where a potential crossing would be made to skid logs from unit 8. Resource protection measures described in this report as well as Appendix A would minimize impacts to the stream bank in this location. Work near the flume is not likely to result in a level of ground disturbance that would lead to any soil erosion or sediment transport.

Increased transport of metals from contaminated mining sites to stream channels is unlikely to occur as a result of the proposed action, as there are no contaminated sites identified within the project treatment units.

The proposed activities are not likely to measurably influence stream temperatures, as streamside canopy removal is proposed only for short sections of stream immediately adjacent to the flume. Canopy removal along these sections of stream and the flume could result in a temperature increase in water flowing to Chessman Reservoir and Beaver Creek. However, any temperature change in the flume is likely to be muted through solar warming of Chessman Reservoir, which will occur unmodified by any project activity. The segments of Beaver Creek tributaries to be treated are likely too short to result in measurable increases in stream temperature in Beaver Creek.

Although some wetland areas were identified in the treatment units, mechanical equipment would operate in these areas only during appropriate winter conditions, or not at all (see Soils Report). Such operating restrictions would minimize disturbance and would not significantly impact the hydrologic function of the wetlands.

Cumulative Effects

Several past and present federal and non-federal activities have affected and continue to affect water quality, water yield, and riparian function in the cumulative effects analysis area. Past timber harvest has likely caused temporary increases in water yield and sediment delivery in the past, though these effects generally attenuate over time. Extensive mining history in the upper Tenmile drainage has left a legacy of metals, sediment, and heavily modified riparian areas and aquatic habitat in the analysis area. In some cases, ongoing mining activity continues to be a chronic source of sediment to streams and of

riparian degradation. Old mine workings can also pose chronic or episodic water quality problems to forest streams. Past pulses of elevated sediment (e.g. from timber harvest or mining) can remain in stream channels (banks and bed) for many years following deposition.

In the analysis area, water yield most likely has been and would continue to be affected by large-scale tree mortality. Large-scale loss of live trees reduces the volume of water removed from a watershed by transpiration. Increases in water yield could result in higher peak flows, although this is generally limited to events of lower magnitude (Grant et al., 2008). The proposed action would not contribute to this process as the vast majority of trees to be removed are already dead, and the area to be treated would be a small percentage of the watersheds analyzed.

Extensive tree mortality will also affect stream temperature in streams that cross the affected stands. However, understory vegetation, generally unaffected by insect mortality, will continue to provide shade. Furthermore, understory and riparian vegetation exposed to increased levels of sunlight (due to overstory mortality or tree removal) can expand and provide additional shade (Gravelle & Link, 2007). While an increase in incoming short-wave (solar) radiation is generally considered to be the dominant driver of stream temperature increase, numerous factors influence the extent to which a stream exposed to additional direct sunlight would have an increase in water temperature (Johnson, 2004). Thus, the extent of water temperature changes resulting from overstory mortality is difficult to predict. In any case, the likelihood that the proposed action would meaningfully contribute to any stream temperature increase is small, given the small area of treatments along stream channels (any water temperature increase in the flume would be immeasurable downstream of the reservoir).

Reasonably foreseeable federal and non-federal activities that could affect water quality, water yield, and riparian health and vigor in the cumulative effects analysis area include future cutting/removal of trees (e.g. broader-scale hazardous fuels mitigation in the upper Tenmile drainage), small-scale mining or failure of old mines, continued livestock impacts in grazing allotments, roads, and fire. Foreseeable timber harvest activities in the analysis area on the National Forest are not likely to substantially affect water quality or riparian-area viability, assuming compliance with the SMZ law and strict adherence to forestry BMPs (Montana DNRC, 2012). The impacts of roads on water quality would be incrementally reduced due to the road maintenance and improvements planned as part of or in conjunction with the proposed action, as well as other road maintenance/improvement projects. Other activities that would serve to reduce sediment delivery to streams in project watersheds will likely be implemented periodically in the future within the cumulative effects analysis area. Such activities include watershed improvement projects, culvert upgrades, and effectively implemented allotment management plan (AMP) revisions, among others. Road obliteration work occurs annually on the HNF, and will likely expand substantially in the analysis area upon the release of the Divide Travel Analysis Decision. In a roughly concurrent project in the same area, up to five miles of non-system routes are planned for obliteration in the project area during the fall of 2013. Cumulative impacts would not result from individually minor or collectively significant actions.

Forest Plan Consistency

The proposed project would be consistent with municipal and general watershed provisions in the Helena NF Forest Plan (USDA FS, 1986).

Specifically,

- The project is consistent with management area standards and guidelines (USDA FS, 1986 p II/24),
- The project was developed in coordination with the city of Helena and Montana DEQ (USDA FS, 1986 p II/24-25),
- The project has a "designated FS representative responsible for maintenance of water quality within appropriate state standards," and "each contractor will designate a representative with the authority to take whatever action necessary to remedy any situation which might result in violation of state water quality standards" (USDA FS, 1986 p II/25),
- Project implementation and post-implementation effects will be monitored to ensure that resource protection measures are implemented properly and are effective (USDA FS, 1986 p II/25),
- Pertinent soil and water best management practices (BMPs) or resource protection measures listed in the Forest Service National Core BMP Technical Guide (USDA FS, 2012)) will be implemented (USDA FS, 1986 p II/25),
- Municipal water supply facilities "will be maintained by the permittee in a safe and serviceable condition" (USDA FS, 1986 p II/26)—this is one of the main goals of the project,
- Coordination with NRCS has occurred and allowances in project design were made to accommodate data consistency at the Chessman snow course (USDA FS, 1986 p II/26).

Soils

No-Action

Landtypes have been characterized for the Red Mountain Flume/Chessman Project area in Soil Survey of Helena National Forest Area, Montana (USDA NRCS 2001). There are 10 landtypes mapped within the project area which would be affected by proposed vegetation treatment activities. A summary of key soil characteristics for the 10 landtypes is displayed in Soil Resource Report (Marr 2013)

Parent materials and derived soil properties found across the south eastern portion of the Boulder Mountains are principally underlain by volcanic and granitic rocks. There are minor surface deposits of loess that have been influenced by volcanic ash across this portion of the Helena National Forest. More influential in the project area are those features resultant of extensive glaciation.

Under the no action alternative, finer woody fuels (<3 inches in diameter) and needles would begin to dramatically accumulate on the ground in several years as a result of the mountain pine beetle (MPB) mortality. These conditions greatly increase the likelihood of a wildfire ignition. Additionally, large quantities of MPB-killed trees would likely fall within 10–15 years resulting in substantial accumulations of mostly large fuels (>3 inches in diameter). Litter cast and snags have already begun to fall throughout these areas.

As a result of heavy surface fuels in most areas of the project, if a wildfire became established it could generate very high heat per unit area and be difficult to control. Such a high-severity wildfire would directly impact soil health and site productivity. Intense, longer duration heat near the soil surface could impact microbial activity near the soil surface and result in hydrophobic conditions, increased amounts of bare soil, increased potential for surface runoff, soil detachment, large scale erosion, slower recovery of effective vegetative cover and sedimentation into the municipal water ways. These factors could likely compromise the ability of the flume to transport water and the ability of the landscape around the reservoir to provide a productive soil base which is critical to the Helena Valley's water supply.

Based on my 6 years as a BAER Team Soil Scientist, it is possible that large areas would be severely burned under wildfire conditions, far in excess of the Regional Soil Quality Standards strived for when implementing management activities. The effect would likely be more severe than a prescribed mixed severity fire resulting in a mosaic burn pattern conducted under optimal soil moisture, ideal atmospheric temperatures, under professional supervision and at a more appropriate scale. Refer to the Hydrology Specialist Report for modeled post fire sediment yields upwards of 3.7 tons/acre which is 3-5 times the predicted post fire sediment yield for a typical prescribed fire and in excess of Region 1 SQS.

The FACTS database contains several records for past timber harvest activities in the Red Mountain Flume/Chessman Reservoir Project Area. Harvest activities spanned several decades, with hand pile burning in the 1980's and the rearrangement of fuels in the early 1990's. Sanitation cuts began in 2010 to remove the roadside hazard trees that were a result of the mountain pine bark beetle epidemic. Wildfire was documented to have burned a portion of unit 4 in the 1930's. Documentation of all past harvest units within the project area can be found in the project record. All of these activities were taken into account through the unit specific monitoring conducted in 2013.

Under the no-action alternative, no new management actions are proposed. With no new actions proposed, no new soil effects would occur. However, past and ongoing management activities, such as previous timber harvest, roads and minerals activities would continue to affect soil resources similar to impacts described above in this analysis.

Proposal

A summary list of landtypes and acres treated by vegetation treatment activities proposed for Alternative 2 can be found in Table 2. More detailed information disclosing the specific landtypes treated within each proposed vegetation treatment unit can be found in a spreadsheet in the soil project record.

Table 11. Acres of landtypes by unit within proposed unit boundaries.

Units	Landtypes (acres)										Total
	120	12C	136	14-	36-	360	56A	76-	77B	80-	
1							4	6			10
2							12				12
3										5	5
4				7	1					21	29
5				4						<1	5
6				8							8
7	10	<1		12					<1	1	24
8	39	3			17					3	62
9										3	3
10	20	15	3		14						52
11	2				28	7					37
12					10	6					15
13						24					24
14	99		3		42	2					147
15	<1		1		56						57
Total	171	18	7	32	168	39	16	6	0	32	489

Under the proposal, .4 mile of temporary road construction would have short-term impact on approximately 1.2 acres of soil. For the purposes of this analysis, soil effects from temporary roads will be included with the area of detrimental soil disturbance associated with tractor yarding units, because the temporary roads would be constructed for ground-based logging equipment to access these units. However, reclamation by full obliteration of temporary roads upon conclusion of proposed vegetation treatments would facilitate long-term recovery of soil productivity on these 1.2 acres and would require no maintenance.

Cumulative Effects

The appropriate geographic area for soil cumulative effects analysis has been defined as the "land area affected by a management activity" (USDA Forest Service 1999). This is because soil productivity is a site-specific attribute of the land. Forest Service Manual 2550.5 defines soil productivity as the inherent capacity of the soil resource to support appropriate site-specific biological resource management objectives, which includes the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses. The productivity of one area of soil is not dependent on the productivity of an adjacent area of land. Similarly, if one acre of land receives soil impacts resulting from management activities and a second management activity that may affect soil is planned for that same site, then soil cumulative effects are possible on that site. Thus, cumulative effects to soil productivity are appropriately evaluated on a site-specific basis.

This site-specific productive function of soil is in contrast to the integrated hydrologic function of a watershed, which is dependent on the integrity of the whole system to maintain proper function.

A total of approximately .6 acres of non-system road would be decommissioned inside units 11, 13 and 14 following completion of the timber sale activities. The decommissioning will expedite the recovery of the effected soils therefore increasing site productivity in comparison to the current recovery trend. The acreage associated with this decommissioning has been discounted from the total anticipated DSD, but results in a small enough percentage of the units that no change in prescription can take place. Details of the acreage and units effected can be found in table 4 and the associated map in the soil project record titled FlumeChessmanNSRoads11x17.pdf.

Soil Disturbance Treatment Scenarios

Detrimental soil disturbance is estimated for the following scenarios which represent the range and various combinations of treatments that could result in soil disturbance under this alternative in addition to field verified existing soil condition.

Ground Based Harvest with Handpile or Jackpot Prescribed Fire
Ground Based Harvest with Broadcast Prescribed Fire
Ground Based with Underburn Prescribed Fire
Hand Treatment with Handpile or Jackpot Prescribed Fire

Table 12: Existing detrimental soil disturbance.

it #	Past activity & year completed	Existing DSD (2013)	Date Surveyed	CWD (tons/acre)
1	none	No Record of Past Activity	Surveyed 6/2013	3.9
2	none	No Record of Past Activity	Surveyed 6/2013	8.83
3	none	No Record of Past Activity	Surveyed 6/2013	0.96
4	Wildfire (1930)	0*	Surveyed 6/2013	1.03
5	none	No Record of Past Activity	Surveyed 6/2013	3.57
6	none	No Record of Past Activity	Surveyed 6/2013	4.9
7	none	No Record of Past Activity	Surveyed 6/2013	1.93
8	Haz. Tree (2010-2012)	No Record of Past Activity	Surveyed 6/2013	2.3
9	none	No Record of Past Activity	Surveyed 6/2013	12.2
10	none	0	Surveyed 5/2013	14.73

it #	Past activity & year completed	Existing DSD (2013)	Date Surveyed	CWD (tons/acre)
11	Haz. Tree (2010-2012), Rearrangement of Fuels (1992)	0	Surveyed 5/2013	10.7
12	Haz. Tree (2010-2012), Rearrangement of Fuels (1992), Hand Pile (1987)	0	Surveyed 5/2013	17.43
13	Haz. Tree (2010-2012), Rearrangement of Fuels (1992), Hand Pile (1987)	0	Surveyed 5/2013	3.57
14	Haz. Tree (2010-2012)	0	Surveyed 5/2013	1.26
15	none	0	Surveyed 5/2013	4.47

*existing DSD was based on visual estimates of the unit as consistent with Region 1 Tech Guide (2011)

Coarse woody debris measurements for Units 1, 3, 4, 5, 6, 7, 8, 13, 14 and 15 are currently below the 5 tons/acre that the Soil Specialists manage to achieve. There is potential for additional recruitment from standing dead within the units. Implementation of this action alternative would result in bringing these units into compliance with residual coarse woody debris levels.

If the proposed harvest units were to be burned by wildfire in the future following treatment, a mix of burn severities would be anticipated depending on topography, fuels and climatic conditions based on my 6 years of experience as a Burned Area Emergency Response team member and monitoring of similar prescribed burn activities. Wildfire that would occur soon after treatment within the activity units may well burn with low burn severity with little detrimental soil disturbance due to the reduction of fuels, a higher amount of live residual trees and less fuel continuity/increased tree spacing.

Predicted erosion yields displayed in the Hydrology Specialist Report illustrate that under conditions more indicative of prescribed fire scenarios (low to moderate severity mosaic fires); erosion rates are anticipated to be well under the 2 tons/acre/year Soil Quality Standard for all units. This is in contrast to modeled post fire sediment yields upwards of 3.7 tons/acre which is 3-5 times the predicted post fire sediment yield for a typical prescribed fire and in excess of Region 1 SQS displayed in the Hydrology Specialist Report.

Units 1, 2, 3, 4, 5, 6, 7, 8, 9 & 10 would be affected by issuance of a SUP to the City of Helena. The issuance of the SUP would result in 100 feet on each side of the Red Mountain Flume being no longer primarily managed for a productive soil base there by turning this land (roughly 65 acres) into an administrative site and excluded from being evaluated by Region 1 SQS. Refer to Table 5 in Appendix A for a more detailed description specifying acreage by unit. Regardless of the issuance of the SUP, prescribed resource protection measures have been designed to maintain less than 15% DSD in these units. Realistically, the areas not exempt from SQS (i.e. those areas beyond the 100 foot SUP) would likely have far less DSD. This statement is made based on the fashion in which the ground based activities will be logistically implemented in Units 4, 6, 8 and a portion of 10. The skid trails would be used less frequently and would be at their maximum spacing.

Table 13: Acres of new detrimental soil disturbance based on proposed vegetation treatments and activity area acres, Alternative 2.

Proposed Activity: Tree Thinning	Proposed Activity: Prescribed Burning	Alt. 2 Proposed Treatment Units	Alt. 2 Treatment Unit Acres	Alt. 2 Acres of Detrimental Soil Disturbance on tractor skid trails corridors in Treatment Units	Alt. 2 Acres of Detrimental Soil Disturbance from Severe burning in Treatment Units (Low)	Alt. 2 Acres of Detrimental Soil Disturbance from Severe burning in Treatment Units (High)	Alt. 2 Affected Acres for Detrimental Soil Disturbance on Log Landings	Alt. 2 Miles of Temp Road **INSIDE** the Unit	Alt. 2 Affected Acres for Detrimental Disturbance on Temporary Roads	Alt. 2 Total Acres of Detrimental Soil Disturbance (incl. skid trails and **low** severity burning, plus log landings & temp. roads)	Alt. 2 Total Acres of Detrimental Soil Disturbance (incl. skid trails and **high** severity burning, plus log landings & temp. roads)	Alt. 2 Total Activity Area Acres (Treatment Units incl. Affected Areas for Temp. Roads & Log Landings)	Alt. 2 Miles of Road Decomissioned inside the unit	Alt. 2 Acres of Activity Area reclaimed by decomissioning (road decom. inside units)	Alt 2. Percent of Unit effected by road decom.	Alt. 2 Percent of Activity Area with Detrimental Soil Disturbance (Low)	Alt. 2 Percent of Activity Area with Detrimental Soil Disturbance (High)	Winter log w/low severity burn	Winter log w/high severity burn
Ground Based	Handpile or Jackpot	4	29.0	2.1	1.5	-	0.7	0.0	0.0	4.3	-	29.0	0	0		14.9%	-	9.9%	
Ground Based	Handpile or Jackpot	6	8.0	0.6	0.4	-	0.2	0.0	0.0	1.2	-	8.0	0	0		14.9%	-	9.9%	
Ground Based	Handpile or Jackpot	8	62.0	4.6	3.1	-	1.6	0.0	0.0	9.2	-	62.0	0	0		14.9%	-	9.9%	
Ground Based	Broadcast	10	52.0	3.8	1.0	5.2	1.3	0.0	0.0	6.2	10.3	52.0	0	0		11.9%	19.9%	6.9%	14.9%
Ground Based	Broadcast	11	38.0	2.8	0.8	3.8	1.0	0.0	0.0	4.5	7.6	38.0	0.1	0.1	0.4%	11.5%	19.5%	6.5%	14.5%
Ground Based	Broadcast	13	24.0	1.8	0.5	2.4	0.6	0.0	0.0	2.9	4.8	24.0	0.12	0.2	0.7%	11.2%	19.2%	6.2%	14.2%
Ground Based	Broadcast	14	147.0	10.9	2.9	14.7	3.7	0.0	0.0	17.5	29.3	147.0	0.2	0.3	0.2%	11.7%	19.7%	6.7%	14.7%
Ground Based	Broadcast	15	57.0	4.2	1.1	5.7	1.4	0.4	***1.2***	8.0	12.6	57.0				14.0%	22.0%	9.0%	17.0%
Ground Based	Underburn	12	15.0	1.1	0.6	-	0.4	0.0	0.0	2.1	-	15.0	0	0		13.9%	-	8.9%	
Hand Treatment	Handpile or Jackpot	1	10.0	0.0	0.5	-	0.0	0.0	0.0	0.5	-	10.0	0	0		5.0%	-		
Hand Treatment	Handpile or Jackpot	2	12.0	0.0	0.6	-	0.0	0.0	0.0	0.6	-	12.0	0	0		5.0%	-		
Hand Treatment	Handpile or Jackpot	3	5.0	0.0	0.3	-	0.0	0.0	0.0	0.3	-	5.0	0	0		5.0%	-		
Hand Treatment	Handpile or Jackpot	5	5.0	0.0	0.3	-	0.0	0.0	0.0	0.3	-	5.0	0	0		5.0%	-		
Hand Treatment	Handpile or Jackpot	7	24.0	0.0	1.2	-	0.0	0.0	0.0	1.2	-	24.0	0	0		5.0%	-		
Hand Treatment	Handpile or Jackpot	9	3.0	0.0	0.2	-	0.0	0.0	0.0	0.2	-	3.0	0	0		5.0%	-		
			491.0	**32.0**	**14.9**	**31.8**	**10.8**	**0.4**	**1.2**	**58.8**	**64.5**	**491.0**	**0.4**	**0.6**					

Ground Based Harvest with Handpile or Jackpot Prescribed Fire
Units 4, 6 and 8 are anticipated to comply with Region 1 SQS and Helena National Forest Plan requirements. Approximately 43 acres of soil would be removed from being primarily managed for soil productivity therefore excluding this from evaluation as specified by Region 1 SQS through issuance of the SUP to the City of Helena.

Ground Based Harvest with Broadcast Prescribed Fire
Decommissioning of existing non-system road templates will be conducted in Units 11 (.1 acre), 13 (.2 acres) & 14 (.3 acres) totaling approximately .6 acres resulting in reclamation of these lands since the decommissioning activity is setting these areas on a trend for recovery as directed by Region 1 SQS (USDA Forest Service 1999). For a complete breakdown of the length of non-system road templates, refer to Table 4 above and the corresponding Soil Resource project record spreadsheet.

Including the acreage of reclamation from decommissioning as outlined above, Units 10, 11, 13, 14 and 15 would need mitigation from the proposed activity to comply with Region 1 SQS.

As outlined in Table 4 above, options to proceed would require that following summer ground based harvest, burning target the low end of burn severity, which would result in 5%-10% bare soil (as described in the Assumptions section above for this burn prescription) or these units be harvested under winter conditions with ground based equipment, which would allow the burn prescriptions to be implemented as currently prescribed with the exception of Unit 15.

In order to meet Region 1 SQS Unit 15 burning would have to target the low end of burn severity under either summer or winter condition ground based harvest. Approximately 2 acres of soil would be removed from being primarily managed for soil productivity therefore excluding a portion of Unit 10 from evaluation as specified by Region 1 SQS through issuance of the SUP to the City of Helena.

With the adoption of these additional mitigations, all units are anticipated to comply with Region 1 SQS.

Ground Based with Underburn Prescribed Fire
Unit 12 is anticipated to comply with Region 1 SQS and Helena National Forest Plan requirements.

Hand Treatment with Handpile or Jackpot Prescribed Fire
Units 1, 2, 3, 5, 7 and 9 are anticipated to comply with Region 1 SQS and Helena National Forest Plan requirements. Approximately 20 acres of soil would be removed from being primarily managed for soil productivity therefore excluding this from evaluation as specified by Region 1 SQS through issuance of the SUP to the City of Helena.

Forest Plan Consistency and Conclusions

It is my professional judgment that with the implementation of resource protection measures with the proposed treatments, then all proposed actions for this project would comply with Region 1 soil quality standards to limit detrimental soil disturbance, as well as meet Helena Forest Plan and NFMA requirements to conserve site productivity while meeting the purpose and need for this project.

Anticipated, predicted and modeled contrasts between the proposed action and no action alternative portray the importance of implementing the proposed project activities analyzed above.

I make this determination based on previous monitoring of similar activities across the Helena National Forest employing resource protection measures with monitoring proven effectiveness and associated BMP audits documenting that soil and water Best Management Practices are effective when implemented successfully (Montana Department of Natural Resources and Conservation 2000 and 2002; USDA Forest Service 2003).

For further clarification and detail and other consideration regarding the soil resource for this project area, refer to the Soil Resource Report filed in the project record.

Vegetation

The Flume Chessman Project is focused on the need to reduce the risk of damage occurring to the Red Mountain Flume and Chessman Reservoir. The information presented here focusses on the vegetation character pertinent to that need regarding the forest stands along the flume and around the reservoir. The character presented here is briefly summarized below.

- *Landscape Processes*: Landscape processes include forest succession, insects, disease, and wildfire. The area impacted by the proposal is relatively small and no alternative would have a measurable impact on these large-scale processes; therefore is not discussed in this document but is addressed in the Forested Vegetation Report filed in the project record.
- *Vegetation Composition and Structure*: The areas of analysis are dominated by subalpine fir and Douglas-fir climax habitat types, most of which were dominated by seral lodgepole pine prior to the mountain pine beetle outbreak. This insect has caused substantial changes to

vegetation in the past several years by killing a high proportion of the mature pine trees. The proposed action would alter the structure and composition of treated areas by removing dead and dying trees, reforesting stands, and thinning green trees. This would promote low surface fuels and seral species composition. Given the small scale of the project, however, landscape level vegetation conditions would not be substantially altered.

- *Insects and Disease*: While the mountain pine beetle has been the most active insect recently, other insects such as western spruce budworm and Douglas-fir beetle and pathogens such as white pine blister rust also have impacts to forested vegetation. The proposal would have some impact to the potential activity of these insects and pathogens within the treatment units (generally lowering susceptibility) but would not have a measurable impact at the landscape scale.
- *Habitats of Special Concern* (old growth, snags, whitebark pine, ponderosa pine, and aspen): There would be no measurable impact to old growth with the proposal, with the exception of a small 4-acre overlap in one treatment unit. No living old trees would be cut in this area. Snags would be cut within the treatment units; however due to the abundance of snags across the analysis areas, there is little measurable impact to the average snags per acre at the third order drainage scale. Whitebark pine, ponderosa pine, and aspen are all present in proposed treatment areas in small amounts. These species would be retained and promoted; however, treatments would not be at a scale to make an appreciable difference in the overall abundance or health of these species at the landscape level.

To attain additional knowledge of a more comprehensive view of the vegetative settings surrounding the project area, refer to the Forested Vegetation report filed in the project record. In that report you will get a clearer perspective of the larger comprehensive situation found in the Tenmile Watershed and learn more on regulatory direction, information used, methodology used in this analysis, and the how vegetative processes interact with other landscape processes.

This analysis utilized the Region 1 Existing Vegetation Map Product (R1-Vmap), which is a vegetation map product by the Northern Region Geospatial group (USDA 2011a; USDA 2009a). It's a satellite imagery based map that groups information into vegetation that is alike and organized by polygon-based map units. Other pertinent information is attached to these polygons, using a digital elevation model, which includes the majority elevation, slope, and aspect.

The R1-Vmap product produced for the HNF was taken in 2005 and 2006. Since that time, the Helena experienced a mountain pin beetle (MPB) epidemic. To update the R1-Vmap, recent inventory data was used to create a model that depicts the current situation. Therefore there are two R1-Vmaps that exist; one called "prekill" that represents vegetation conditions that existed prior to the epidemic and the other called "postkill" or "PK", which is used to describe the current condition based on the MPB outbreak.

'Biophysical settings' is a term used in this analysis and are land delineations based on the physical setting of an area, elevation and aspect and the potential natural vegetation that can occupy a specific environmental setting (Hann and Bunnell 2001; Hann and Strohm 2003).

There are seven biophysical settings that occur within the projects area. There are four that overlay with the proposal's treatment units. They are:

- **Douglas-fir interior Northern and Central Rocky Mountains-Dry (DFIR1-D):** The warm dry segment of DFIR2 occurs on south, west, southeast, and southwest aspects. It ranges in elevation from 5,500–6,200 feet. Douglas-fir is the dominant conifer, with the understory dominated by snowberry trending to grass. Common juniper can be a major component. Ponderosa pine and lodgepole pine can occur occasionally. The habitat types are Douglas-fir climax types, and sites are more moist and productive than ponderosa pine sites. These sites typically border ponderosa pine climax sites or grasslands. These drier Douglas-fir forests are often found on harsh aspects (south or west), and timber productivity is low.
- **Douglas-fir Interior Northern and Central Rocky Mountains-Moist (DFIR2-M):** The moist segment of DFIR2 is cooler, found on all aspects at elevations of 6,200-6600 feet. This setting is dominated by a mix of Douglas-fir and lodgepole pine. This split was made to reflect the higher occurrence of lodgepole pine due to the change in aspect. The understory is generally dominated by pinegrass (*Calamagrostis rubescens*). The habitat types in this setting are Douglas-fir or spruce climax forests. These areas are more moist and productive (generally moderate) than the warm DFIR2 setting and are more likely to be found on north and east aspects, and at slightly higher elevations. Lodgepole pine is a common seral component or dominant species.
- **Interior West Lower Subalpine Forest (SPFI1):** This setting occurs in the lower subalpine zone—6,600 to 7,000 feet—on gentle to moderately steep terrain. Lodgepole pine is generally the most common conifer, with Douglas-fir, subalpine fir, and Engelmann spruce occurring as well. Whitebark pine occurs at the upper elevations. More moist sties can be dominated by subalpine fir and spruce. Many habitat types are included in this setting, primarily subalpine fir climax types but a few spruce and lodgepole pine habitat types as well. The subalpine fir series typically border the spruce or Douglas-fir climax forests on their lower bounds in eastern Montana.
- **Interior West Upper Subalpine Forest (SPFI2):** This setting occurs in the upper subalpine zone. These areas are above 7,000 feet and are moderately steep to steep terrain. Relatively dry, cold sites are dominated by whitebark pine, Engelmann spruce, and subalpine fir. These border subalpine fir forests and are bounded by timberline at upper elevations. Lodgepole pine is often a dominant seral component as well as whitebark pine, and timber productivity is generally high. In the absence of disturbances, shade-tolerant subalpine fir eventually dominates.

Also evaluated in this project were requirements from the National Forest Management Act (NFMA) that governs management of National Forest Lands. Items such as vegetation manipulation, even-aged management, etc. were addressed.

Effects Common to both No-Action and Proposal

At all scales, the natural world is in a constant state of change. Some changes, such as wildfire and insect outbreaks, can occur quickly and cause rapid visible changes, while other processes such as forest succession result in slow, incrementally small changes less noticeable to the human eye. Dominant

processes include succession, decay and nutrient cycling, and disturbances such as fire, blow-down, insects, and diseases. These ongoing changes would continue with both the no-action and proposal with the only difference in those acres treated.

No-Action

The small project area is dominated by only a few biophysical settings. DFIR2-D represents 16%. Lodgepole pine-dominated settings (DFIR2-M and SPFI1) cover 73%. A small amount of SPFI2 is also present; it is in these areas that whitebark pine is mostly likely to occur, although it may also be found in SPFI1.

By definition, the biophysical settings modeled for the HNF is a theoretical constant. Therefore there is no direct or indirect impact to these characteristics with the No-Action alternative. The seral stage and condition of these areas may shift, but not the potential vegetation classification.

VMap prekill and postkill are displayed to summarize three attributes of vegetation prior to and after the MPB outbreak: type size, and density. These are summarized at the project area scale. Some water areas such as the reservoir have been mapped as "sparsely vegetated" rather than "water"; this has no impact on the forested vegetation analysis.

Currently, the project area is dominated by mature lodgepole pine dominated forests that have recently been killed by the MPB. Most of the dead trees are still standing, but will soon fall. Comparing the pre- and post-kill conditions displays the evident and logical effect caused by the MPB infestation. Vegetation dominance types pre- and postkill for the project area are displayed below.

Table 14: Dominance Group Pre- and Postkill, Project Area

Dominance Group	Project Area	
	Pre-Kill Acres/%	Post-kill Acres/%
Non-Forested	438 / 9%	438 / 9%
ponderosa pine	19 / trace	19 / trace
ponderosa pine intolerant mix	0 / 0	0 / 0
Douglas-fir	766 / 16%	1,478 / 31%
Douglas-fir intolerant mix	404 / 8%	0 / 0%
lodgepole pine	2,657 / 56%	1,919 / 40%
lodgepole pine intolerant mix	449 / 9%	0 / 0%
lodgepole pine tolerant mix	0 / 0%	0 / 0%
subalpine fir	5 / trace	436 / 10%
subalpine fir tolerant mix	6 / trace	6 / trace
Engelmann spruce	0 / 0	0 / 0%
Engelmann spruce tolerant mix	7 / trace	7 / trace
whitebark pine	0 / 0	0 / 0
whitebark pine intolerant mix	12 / trace	0 / 0
aspen	0 / 0	0 / 0
intolerant mix	0 / 0	0 / 0
tolerant mix	0 / 0	0 / 0

There would be no direct effect to dominance groups in the short-term with No Action. Over time dominance groups would continue to shift according to natural successional pathways, influenced by natural disturbances. MPB has recently caused a shift away from lodgepole pine composition in areas with more shade tolerant components, primarily Douglas-fir and subalpine fir. In areas with little to no seed source for shade tolerant species, lodgepole may regenerate in MPB-killed areas as serotinous cones are opened by sunlight. In some areas with poor growing conditions, lack of exposed seedbeds, or a lack of seed, regeneration may be patchy or take some time to establish.

Regarding tree class, the beetle has shifted the class, but has maintained and slightly enhanced the homogeneity the landscape. In other words, rather than a landscape dominated by medium to large trees, the landscape is still relatively homogeneous but now dominated by small trees. Large living trees are increasingly rare. The project area is particularly homogeneous postkill, with 81% covered by small trees or seedlings/saplings.

Table 15: Tree Size Class, Pre and Post-kill, Forested Areas Only

Tree Size Class	Project Area	
	Pre-Kill Acres / %	Post-kill Acres / %
0-4.9 dbh, seed/sap	19 / trace	263 / 6%
5-9.9" dbh, small	2,330 / 54%	3,238 / 75%
10-14.9" dbh, med	1,623 / 38%	609 / 14%
15"+ dbh, large	353 / 8%	216 / 5%

There would be no direct effect to size class if natural processes are allowed to continue. Over time size classes would continue to shift through time according to natural successional pathways, influenced by natural disturbances. In the short-term medium and large trees are rare; in the long-term, the reverse may be true.

Tree density is described using four classes of canopy cover as displayed in the table below. The amount of forests with low canopy cover has increased substantially while those with high cover have decreased substantially due to the MPB.

Table 16: Tree Canopy Cover Classes, Pre and Post-kill, Forested Areas Only

Tree Canopy Cover Class	Project Area	
	Pre-Kill Acres / %	Post-kill Acres / %
10-25% Low	401 / 9%	885 / 20%
26-40% Low/Mod	384 / 9%	1,231 / 28%
41-60% Mod/High	1,245 / 29%	1,558 / 36%
>60% High	2,297 / 53%	652 / 15%

There would be no direct effect of the No Action alternative to tree size class. Over time size classes would continue to shift through time according to natural successional pathways, influenced by natural disturbances. In the short term medium and large trees are rare; in the long term, the reverse may be true.

Vegetation character would not be changed in the short-term with No Action but would slowly change over time through succession and other natural events such as the recent MPB outbreak. Dead and dying trees would eventually fall and the shade tolerant regeneration would persist and grow where present. In openings and areas without shade tolerant species, it is likely that lodgepole natural regeneration may establish as serotinous cones open with the sun's heat. Eventually these new stands may become mature dominated by lodgepole pine.

Conditions within the proposed treatment units are similar to those described for the Project Area. The proposed units adjacent to the reservoir are primarily subalpine fir habitat types, with some Douglas-fir climax areas. The units along the flume are all subalpine fir climax types. Throughout the proposed units, there are some limited areas containing sapling lodgepole pine that have survived the beetle outbreak, as well as some5-needled pine seedlings and saplings, Engelmann spruce, and subalpine fir. Downed natural fuels are variable, and will increase substantially as dead trees fall. There is relatively little shrub development currently. One stand adjacent to the reservoir is Douglas-fir dominated, containing a mix of lodgepole pine which has been killed but relatively healthy medium to large diameter Douglas-fir remain along with rare ponderosa pine, 5-needled pine, and aspen. The following table and figure show summarize conditions within proposed treatment areas.

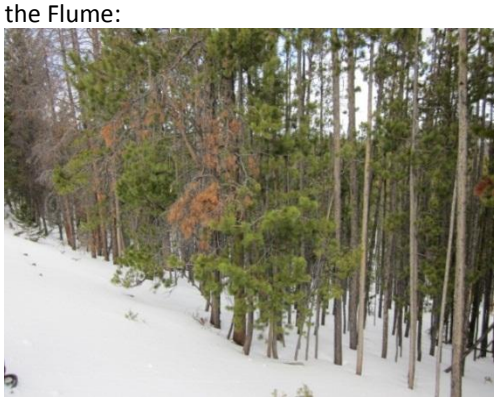
Table 17: Existing Vegetation Condition, Proposed Treatment Areas

Proposed Unit(s)	Species Composition	Density & Age	Structure	Other Considerations
Flume, Fuel Break Treatments (Units 1-9, 158 acres)	Variable, overall 90%+ lodgepole	Variable, overall >180 BA/ac and >100 years old	DBH varies from 2-12"+. Primarily single storied with some patches of shade tolerant re-initiation.	Seedling/sapling 5-needled pines in patches. >90% mortality of lodgepole. Light budworm, mistletoe.
Chessman, Regeneration Harvest (Units 10, 11, 13-15, 317 acres)	90%+ lodgepole; traces of Douglas-fir, subalpine fir, spruce, aspen.	120-200+ BA/ac. >140 years old.	Average 10-11" dbh. Primarily single-storied, with some patches of 2+storied and layered shade tolerants (spruce/fir) in Unit 15.	Traces 5-needled pines in understory, Units 11-14. >90% mortality of lodgepole. Light budworm, mistletoe.
Chessman, Intermediate Harvest (Unit 12, 15 acres)	50% Douglas-fir, 40% lodgepole, traces aspen and ponderosa pine.	Average 120 BA/ac, 140 years old.	Average 12" dbh. Two storied with Douglas-fir and 5-needled pine re-initiation.	Suppressed aspen, scattered 5-needled pine. Light -moderate budworm; Douglas-fir beetle hazard.

Figure 10: Representative Photographs of Proposed Treatment Areas

Medium size, dead lodgepole pine adjacent to the Flume:

Small size, living lodgepole pine adjacent to the Flume:



Typical Flume corridor, dead and dying lodgepole:

Shade tolerant recruitment along Flume:

Dead mature lodgepole adjacent to the Reservoir:

Shade tolerant recruitment in Unit 15:

Douglas-fir dominated stand adjacent to reservoir:

Aspen opening in Douglas-fir stand adjacent to reservoir:

Small, surviving trees adjacent to the Reservoir:

Under Alternative 1, there would be no direct changes to the vegetation conditions within proposed treatment areas in the short term. These areas would continue along a natural trajectory. Over time, dead lodgepole pine would fall creating a very large loading of heavy fuels adjacent to the flume and reservoir. Natural regeneration is likely to occur as sunlight opens serotinous lodgepole pine cones, and/or advance regeneration of shade tolerant trees persists. Existing surviving green trees would grow slowly in size and density over time. The following table describes the effects of No Action to these areas.

Table 18: Effects to Vegetation in Proposed Treatment Units, No Action

Proposed Unit(s)	Direct and Indirect Effects
Flume Areas (158 acres)	Patches of shade tolerant trees will persist, and in some limited areas give rise to multi-storied areas. However, most areas would eventually be dominated by lodgepole pine regeneration, in a 1-storied condition. Dead mature lodgepole would fall and create very high fuel loadings. 5-needled pines may persist for some time but would likely be outcompeted by other species eventually.
Chessman Regeneration Areas (317 acres)	
Chessman, Intermediate Areas (15 acres)	Little change in the short term. The mix of dead lodgepole would fall and create a moderate to high fuel loading in patches. Aspen would continue to decline. 5-needled pines may persist for some time. Mature Douglas-fir would likely persist with the potential hazard to DFB increasing with densities and diameter. Douglas-fir and lodgepole regeneration would likely establish in openings and eventually develop a 2-storied character.

The MPB outbreak began roughly in 2006, peaking in 2008 and 2009. It has now subsided, largely due to host trees being depleted. The forested areas in the project area experienced 100% infestation by MPB. The beetle was quite successful due to the preponderance of mature, dense lodgepole-pine forests. There would be no direct or indirect effects as the MPB has progressed out of the outbreak phase and will remain on the landscape in endemic quantities. Other insects and diseases are present in the project area including western spruce budworm, with Douglas-fir beetle and pine engraver. White pine blister rust is infecting whitebark pine and dwarf mistletoe in lodgepole pine was also likely present in the mature stands prior to the MPB outbreak. Current trends would likely see these other insects and diseases continuing in and outside the project area.

Whitebark Pine was added on the Region 1 Regional Forester's Sensitive Species list on December 24, 2011. Fish and Wildlife Service has identified threats of which has raised concerns about its long-term viability. Whitebark Pine has been identified by stand examination, walk through surveys, and stand diagnoses on about 559 acres within the project area. With No Action there would be no direct or indirect impacts of management. Conversely, no recommended elements of white bark pine restoration would be implemented. A downward trend would continue to be perpetuated.

Ponderosa pine and aspen are also considered species of special concern for the HNF. Habitats for ponderosa pine are rare on the HNF and tend to occur adjacent to non-forest areas, near valley bottoms, and on dry, harsh aspects and ridges at lower elevations. Therefore, ponderosa is a quite rare in the project area. Aspen is also known to be present only as small suppressed clones scattered in the units near the reservoir. Encroachment and overtopped by conifers along with grazing by herbivores and the absence of fire has contributed to being less common than it was historically (Brown and DeByle 1987; Shepperd et al., 2001).

With No Action, no ponderosa pine or aspen would be directly impacted in the short-term. The aspen that occurs would likely persist for a time but would continue to decline unless a natural disturbance allows the clones to rejuvenate. The rare ponderosa pine would likely persist in the short-term and be a potential minor component into the future, but is not likely to be in good vigor or increase in abundance.

Old growth is a relatively rare feature on this landscape because of the mortality of lodgepole pine, and the fact that stands of species other than lodgepole pine are limited. Old growth is consistent with the standard in the Forest Plan because 5% of each 3rd order drainage in the project area has been designated as managed for old growth according to the priority criteria where possible. No management would occur in or near any old growth stand with No Action.

As evidenced by the MPB outbreak, snags are abundant across all scales of interest. These are primarily medium to large sized dead lodgepole pine snags. This snag pulse is transitory on the landscape, and after these trees fall snags could become rare. Snag retention is consistent with the snag standard in the Forest Plan in the project area with No Action because the average snags per acre in each 3rd order drainage far exceeds the minimum 2 per acre specified in the Plan. Over time, snags would continue to be recruited via natural disturbances. Public firewood cutting is permitted and could reduce the snag

resource adjacent to roads; however, in general the current abundance of snags would be maintained in the short term until they are lost over time from natural attrition. As that occurs, snags may become limited. The timing of when dead trees shift from a vertical to horizontal position varies. In a study done on MPB-killed lodgepole pine, dead trees began falling 3 years after death in thinned stands and 5 years after death in unthinned stands and 90% had fallen by year 12 and 14 respectively (Mitchell and Preisler 1998). Due to the limited age class diversity, after the snags created by this MPB outbreak fall there would be few snags >7" diameter until the forests regenerate, mature, and begin to die again.

Over all, about 467 acres in the project area, roughly 10% have been affected by previous harvest or fuels treatments. These areas likely contain younger and/or more open forests today than untreated areas. The No Action alternative would not add to these areas; 90% of the project area would remain untreated.

With No Action, the requirements regarding assurance of reforestation, consideration of effects, suitability for timber production, optimum harvest method, site-specific prescriptions, and maximum opening size limits do not apply. Furthermore, no openings over 40 acres would be created.

There would be no short-term direct impacts to vegetation structure and composition, insects and disease, or habitats of special concern. Indirect effects relative to natural processes and current trends would continue to impact these characteristics at all scales of analysis through time, including succession and potential disturbances. Notably the trees recently killed by MPB would fall to the forest floor over time in proximity to the flume and reservoir, creating high levels of large downed woody fuels.

Proposal

The proposal treatments are designed to promote healthy forests while minimizing hazardous fuel conditions in the short and long-term. The areas adjacent to the flume would be treated as a mosaic to create a fuel break. Prescriptions would include clearcut with leave trees and thinning of hazardous fuels in areas with small diameter and/or living trees. All dead and dying trees would be cut, and living trees thinned to a very open spacing to ensure crowns do not touch. The goal in units adjacent to the reservoir is to reduce the potential for a high severity wildfire which would in turn reduce the probability of post-wildfire ash and sediment delivery into the reservoir. This would be accomplished by reducing surface fuels, reduce ladder fuels, remove dead and dying trees, re-establish vigorous seedlings where needed, and/or maintain an open canopy of healthy trees where available. The prescriptions employed in these areas include clearcut with leave trees and improvement harvest. All cutting treatments would be followed by prescribed fire. In the fuel break areas, fuels would generally be treated with jackpot and/or handpile burning. Broadcast burning would occur after harvest in the Chessman reservoir units. Treatment methods are based on the most feasible means of removing fuels such as mechanically because ground-based equipment enhances efficiency and safety. Other units would be accomplished by hand because ground-based equipment would be infeasible. In addition to these treatments, there would be an issuance of a special use permit for the city of Helena to conduct maintenance treatments on the right-of-way for the flume. This would be an increase from the present permit of 15 feet (7 ½ feet either side of flume) up to a total of 200 feet (100 feet either side of the flume).

The effects to forested vegetation within proposed treatment units is summarized in the table below.

Table 19: Direct and Indirect Impacts to Forested Vegetation Composition and Structure, Proposal

Proposed Unit(s)	Direct and Indirect Effects
Flume Areas (158 acres) Chessman Regeneration Areas (317 acres)	Removal of stand dead/dying trees in the short-term would result in very open overstory conditions, similar to what will occur with the current trend over time as dead trees naturally fall to the ground. Isolated patches of shade tolerant trees would be retained. Limited areas along the flume would have widely spaced Douglas-fir retained. Most areas would eventually be dominated by lodgepole pine regeneration, in a 1-storied condition. Surface fuel loadings would be low into the long-term. 5-needled pines would be retained, and establishment of new seedlings may occur through the creation of openings and burning. In the long-term, the units adjacent to reservoir would again support lodgepole pine forests. Limited patches of subalpine fir/spruce in these areas may persist or establish, but generally these forests are not expected to develop a multi-storied character. Such patches are currently very limited immediately adjacent to the reservoir. The habitat types present would not generally support tall shrubs of any kind. Eventually (80-100 years) these even-aged forests may likely look similar to the forests that were present prior to the MPB-outbreak, but with slightly lower density and larger individual tree size, making them less susceptible to MPB and wildfire. However, MPB and wildfire hazard will exist at the late seral phase and be likely to again replace them. Adjacent to the flume, open conditions would be maintained more precisely through time so that the area functions as a fuel break. Hand thinning and potentially handpiling/burning would be needed through time to maintain these areas as very open forests, less than 100 TPA through the sapling and pole phases. Eventually, the mature trees in these areas would constitute less than 40 BA/ac. Based on habitat type some areas along the flume would have the potential to develop a multi-storied condition; however, to meet fuel break objectives, generally multi-storied conditions would likely be eliminated by maintenance treatments. Some tall shrub development could occur in places (alder) depending on habitat type.
Chessman, Intermediate Areas (15 acres)	Immediate reduction in tree density would occur in the short term. Dead/dying lodgepole pine removed followed by burning so the surface fuels would be low. Aspen would be likely to increase in vigor and extent through the removal of competing species and burning. Rare ponderosa pine and 5-needled pines would be favored and may increase in vigor through removal of competing trees. Large diameter Douglas-fir would be retained and bark beetle hazard reduced by reducing density. Burning would eliminate conifer regeneration in the short term, but re-establishment of new conifers in openings would likely occur in the mid to long term without repeated low-severity disturbance. Long-term, the open mature forest condition would be maintained indefinitely and provide late-seral forest habitat while also having conditions that lower fire risk. Over time (10-15 years) an understory of young conifers may develop, and it is likely that to maintain low fire risk conditions these trees may be thinned through hand treatments or prescribed fire. Eventually the stand may experience forest health problems such as Douglas-fir beetle. When the stand is no longer viable, natural regeneration is likely to be abundant under the open canopy. This area is not expected to support tall shrub cover.

There would be some impacts to the insects and diseases within the treatment units. However, due to the small size of the project, landscape presence and function of insects and diseases would not be measurably impacted.

The effects to whitebark pine would be limited to the treatment unit themselves. Landscape conditions and trends would be the same as the No Action. Whitebark pine restoration is not a part of the purpose and need. However, the project would seek to "do no harm", and by virtue of its design would have benefits to this species. No whitebark would be cut and to the extent possible individuals of all size classes would be protected from logging equipment as well as fire mortality through ignition methods and slash distribution techniques. Tree cutting and prescribed fire would also remove competing species and create desirable openings for whitebark pine regeneration. The treatments therefore contain elements of restoration treatments described by Keane and others (2012), including using fire to encourage regeneration, implementing silvicultural cuttings to reduce competition and increase vigor, and promoting natural regeneration. To a small extent, the proposal would address some of the threats to whitebark pine (USDI 2011) on a very small scale. Effects to ponderosa pine and aspen would also be limited to the treatment units. While promotion of these species is not part of the purpose and need, the project would have benefits to both. Ponderosa pine and aspen would be retained where they occur and competing trees of other species removed. Treatment would open stands up and create growing conditions beneficial to both these seral species.

Treatments would do little to alter any disturbances that may impact old growth. In the immediate vicinity of treatment units, there may be somewhat of a buffer from severe fire behavior depending upon the fire event, as fire within the treated acres would be less intense due to less fuel. No treatments are proposed in old growth, with the exception of a 4 acre incidental overlap in Unit 11. This patch is a small anomaly in this 71-acre Douglas-fir dominated stand, which does not yet meet old growth definition criteria but was determined to be "next best thing" because it is one of the few stands in the watershed dominated by living, mature trees. The overlapping patch is located in a corner adjacent to the Chessman reservoir, and is separated from the rest of the old growth stand by a road. The inclusion is a result of the inherent diversity captured by logical stand delineations. The old growth stand would not be re-delineated to exclude this area, because the stand examination data that resulted in its designation is statistically viable for the existing delineation. It is important, however, to include this patch with the treatment unit because it contains dead trees directly adjacent to the reservoir. The trees that would be cut are not materially different than what could potentially be cut by firewood cutters along the road. Removal of this material would not affect any of the minimum criteria that contribute to the stand being considered old growth. The treatment would be similar to a small roadside hazard tree removal or firewood cutting patch and would not materially impact the overall stand structure or condition.

Most snags within proposed treatment areas would be felled and potentially removed. Snag retention is not a goal based on the purpose and need, particularly in the fuel break areas along the flume. No snag retention guidelines are applied to the flume units. However, within the Chessman units, retention of some snag habitat is feasible. As described in Design Features, any large diameter snags >20" dbh other than lodgepole encountered would be retained, along with any whitebark pine snags encountered. These are expected to be rare.

Due to the extensive number of snags across the third order drainages, and relatively small area proposed for treatment, the loss of snags in cutting units does not materially change the average snags

per acre. The numbers remain far in excess of the Forest Plan minimum standard of 2 per acre in the short-term. The assessment of bark beetle snags shown in the table below provides a minimum estimate that assures that Forest Plan standards are met.

Table 20: Alternative 2 Post-Treatment Snags/Acre in Third Order Watersheds

3rd Order Drainage	ADS # trees killed by bark beetles 2006-2012	Average Snags/acre	# Snags in Treatment Units, Potential to be Cut	Number of Beetle-created Snags Remaining Post-Treatment	Post-Treatment Alt 2 Average Snags/acre
0814	241,610	25	1,553	240,057	**25**
1001-1	636,204	40	25,052	636,204	**38**

In the long-term, snags are likely to become rare on the landscape as the current "snag pulse" is lost to natural snag attrition.

Cumulative Effects

Overall, about 46 acres in the project area, roughly 10%, have been affected by previous harvest or fuels treatments. These areas likely contain younger and/or more open forests today than untreated areas. This proposal would add to these areas by 490 acres, increasing the proportion of the landscape impacted to 20%. 80% of the project area would remain untreated.

- *Landscape Processes*: Landscape processes include forest succession, insects, disease, and wildfire. The small area impacted by past treatments is unlikely to affect these processes at the landscape scale. Similarly, weed management would not have a measurable effect. Grazing may reduce fine fuel loadings (grass) and impact regeneration, and therefore have some impact to wildfire and succession processes. Fire suppression has had, and will continue to have, the largest impact on all landscape processes. To a small scale, the proposal would ameliorate the impacts of fire suppression and alter succession, insect, and disease processes by introducing disturbance; however these effects are limited in scale and would not affect landscape processes.
- *Vegetation Composition and Structure*: Past harvest and fuel activities have had only minimal impacts to vegetation composition and structure, limited to the 10% of acreage treated. These areas may be younger, more open, and/or contain less downed fuel than untreated areas. The primary factors affecting vegetation have been fire suppression and the MPB outbreak. Grazing and weed management has only affected small areas in the project area. The proposal would add to the proportion of stands that contain an open or regenerated trees with low surface fuels (an additional 10%). In untreated areas, composition and structure would continue on current pathways with dead trees falling to the ground and forest succession continuing without disturbance, generally increasing in density and shade-tolerant ladder fuel development along with new regeneration in openings created by MPB.
- *Insects and Disease*: Some past and ongoing activities have interacted with insect and disease regimes, primarily fire suppression. Harvest and fuel treatments would have only impacted these agents within the small areas treated, generally reducing the occurrence and susceptibility to most insects and pathogens. Fire suppression, however, would have impacted

susceptibility to bark beetles in particular by allowing for dense forest development. Alternative 2 would lower susceptibility to insects and diseases within treated areas.

- *Habitats of Special Concern* (old growth, snags, whitebark pine, ponderosa pine, and aspen): It is not known but is possible that harvest or fuels treatments prior to 2000 could have occurred in old growth; this is accounted for in the existing condition. More recent projects would have been designed to avoid old growth in general although roadside hazard tree removal or firewood cutting may have impacted areas adjacent to roads. Fire suppression has impacted old growth by disrupting the natural processes by which old growth develops and/or is replaced. The proposal would minimally add to the area of old growth impacted by tree cutting in a small incidental 3-acre piece of an old growth stand. Only dead and dying lodgepole pine would be removed, not affecting the function of the old growth overall. Similarly, snags would have likely been cut in past harvest or fuel treatment areas, and also removed through personal use firewood cutting. Fire suppression may prevent the creation of snags; while the MPB outbreak has created a multitude of snags. Firewood cutting may reduce snags immediately adjacent to open roads, but not to the extent that the overall project area, particularly average snags per acre, is impacted. Alternative 2 would cumulatively add to the number of snags cut in the project area, slightly reducing the average snags per acre. However snag levels remain abundant (please refer to the Snag section of this document). Past and ongoing activities may have impacted whitebark pine, ponderosa pine, and aspen to some extent. Generally these species would not have been a focus for cutting. The most notable impact is the decline of these species due to fire suppression. Alternative 2 would not detract from this effect by retaining and promoting these species within treatment areas.

Forest Plan Consistency

NFMA (16 U.S.C. 1604) and CFR 219.27

Harvest and fuels treatments, including regeneration harvests, would occur with the proposal. These actions are consistent with NFMA as follows:

- Reforestation within 5 years of regeneration harvesting is assured with the proposal. All sites proposed for regeneration treatment occur on productive habitat types that are biologically suitable for timber production. The technology exists for reforestation. Monitoring of adjacent stands recently harvested in the area show a high probability of adequate desirable natural regeneration. In the event of a failure, seed and capability exists to plant these sites successfully. Of the over 15,000 acres of regeneration harvesting recorded in FACTS on the HNF from 1976 to 2009, over 93% are currently certified as re-stocked.
- The potential effects on residual trees and adjacent stands have been considered in this report.
- Alternative 2 would employ harvest on both suitable and unsuitable management areas. In this project area, the management areas considered unsuitable for timber production are classified as such based on other resource objectives in the Forest Plan, not because the sites have limited growing capability. In these areas the harvesting is used to achieve other resource objectives, primarily related to protecting the infrastructure for a municipal water supply. The harvesting may be primarily considered salvage, as most of the trees that would be removed are dead lodgepole pine.

- Regeneration harvesting utilizing clearcutting has been determined to be the optimum method due to the existing condition and forest type. The stands to be harvested with regeneration systems are dominated by dead lodgepole pine recently killed by MPB. There are no live trees to offer silvicultural system options with regard to residual trees. Further, lodgepole pine ecology dictates that even-aged management best mimics the natural stand replacing regimes of this species.
- Detailed site-specific silvicultural prescriptions would be prepared prior to implementation to document the appropriate vegetative manipulation activities and to prescribe reforestation stocking levels.
- The proposed regeneration harvesting has been considered relative to maximum size limits for areas to be cut per FSM 2400 and 2470.3, as discussed below. However, "such limits shall not apply to the size of areas harvested as a result of natural catastrophic conditions such as fire, insect and disease attack, or windstorm..." (16 U.S.C. 1604 (g)(3)(F). The openings that would be created with the proposal would occur in stands that have sustained catastrophic insect attacks and therefore the opening size limits do not apply.

Openings over 40 Acres (FSM 2400 and 2470.3; Regional Forester's Policy)

Several openings over 40 acres would be created by regeneration harvest with the proposal. Policy requires that the size of harvest openings created by even-aged silvicultural systems normally be 40 acres or less, and the creation of larger openings requires 60-day public review and Regional Forester approval. However, several exceptions are specified. Where natural catastrophic events such as fire, windstorms, or insect attacks have occurred, 40 acres may be exceeded without 60-day public review and Regional Forester approval, provided the public is notified and the environmental analysis supports the decision. The openings that would be created with the proposal occur in stands that have sustained catastrophic insect attacks, and therefore Regional Forester approval is not required. The public would be notified of this action in the Environmental Assessment document. The harvest units, and adjacent units, that create openings over 40 acres are shown in the table below.

Table 21: Openings over 40 acres – Proposal

Unit or Group of Units	Acres	Prescription
Unit 7 + 8 + 9	88 acres	Fuel Break Treatment*
Unit 10	52 acres	Clearcut with Leave Trees
Unit 14	147 acres	Clearcut with Leave Trees
Unit 15	57 acres	Clearcut with Leave Trees

**The Fuel Break Treatment would contain variable retention of trees by implementing a mosaic of clearcut and tree thinning depending on the availability of green trees, but in general be dominated by a regeneration harvest condition.*

Forest-Wide Timber Standards and Objectives

Timber management activities would occur with the proposal; therefore the Forest-wide timber standards and objectives apply. This Alternative is consistent with all standards and objectives as follows:

- The proposal would increase timber productivity on suitable timber land by removing dead and dying trees and establishing desirable reforestation as quickly as possible.

- Timber management activities have been coordinated with other resources through an interdisciplinary process, as documented in the Environmental Assessment.
- The proposal would result in some product recovery which would contribute to a sustained timber yield that is responsive to local industry and national needs.
- Silvicultural examinations and prescriptions shall be completed before any timber manipulation or silvicultural treatment takes place.
- Clearcutting has been determined to be the optimum method in some units due to forest type (lodgepole pine) and existing condition (high mortality from mountain pine beetle).
- Timber stand openings created by even-aged silvicultural systems will normally be 40 acres or less. Creation of larger openings will require a 60-day public review and Regional Forester approval. Exceptions are listed in the Northern Regional Guide. As described in the previous section, the openings to be created occur in stands killed by the mountain pine beetle, which is consistent with the exceptions in the Northern Regional Guide. These openings do not require Regional Forester approval.
- The proposal would utilize silvicultural systems to improve species diversity, growth, and vigor for stands and increase the size diversity and class diversity between stands.
- The infestation has passed in this area, so there is no opportunity to control insects and disease through silvicultural and biological practices, or to harvest stands at high risk for mountain pine beetle.
- The proposal purposely locates cutting units to break-up contiguous natural fuels.
- On suitable timber acres, prescribed burning would maintain timber production by enhancing conditions for natural regeneration of lodgepole pine.
- On all sites, prescribed fire would be incorporated with the timber stand's silvicultural prescription.

Management Areas

The proposal is consistent with the elements of management area guidance relative to forested vegetation.

- H-1: 218 acres of proposed treatments in the proposal are in this MA, consisting of fuel break treatments around the Flume and clearcuts and intermediate harvest adjacent to the reservoir. This Alternative takes steps to provide a satisfactory and safe domestic water supply for the city of Helena by addressing existing threats to the water infrastructure. Timber harvest is being used as a tool to maintain or enhance watershed values.
- H-2: 215 acres of the proposed treatments in the proposal are in this MA, consisting of fuel break treatments around the Flume and clearcuts and intermediate harvest adjacent to the reservoir. The proposal takes steps to provide a satisfactory and safe domestic water supply for the city of Helena by addressing existing threats to the water infrastructure. Also, the proposal would provide healthy timber stands and optimize growing potential over the planning horizon in treated areas by utilizing dead trees in stands that culminated prior to the MPB, re-establishing desirable tree stocking, and increasing vigor of mature trees in the intermediate harvest area.

- T-1: 24 acres of the proposed treatments in the proposal are in this MA, consisting of clearcut treatments adjacent to the reservoir. This Alternative provides healthy timber stands and optimizes timber growing potential over planning horizon by utilizing dead trees in stands that culminated prior to the MPB, and re-establishing desirable tree stocking. Cost effective timber production is achieved through ground-based mechanisms and prescribing natural regeneration.
- T-5: 33 acres of the proposed treatments in the proposal are in this MA, consisting of clearcut treatments adjacent to the reservoir. This alternative maintains timber sites cost effectively by utilizing ground-based harvest systems and prescribing natural regeneration, and providing for healthy stands of timber and timber products.

Old Growth

The proposal is consistent with the old growth standard in the Forest Plan because 5% of each third order drainage has been designated as managed for old growth according to the priority criteria where possible, utilizing the best information available and a reasoned process as documented in the Methodology section. No old growth occurs in proposed treatment units except for an incidental 4 acre overlap in Unit 11 in which no living old trees would be cut; this area is adjacent to the road and reservoir, and the effects of Alternative 2 would not be substantially different than the potential loss of the dead trees to firewood cutters and/or eventual natural snag attrition. The bulk of the 71-acre old growth stand would remain unaffected.

Snags

The proposal is consistent with the snag standard in the Forest Plan because the average snags per acre in each third-order drainage would far exceed the minimum 2 per acre specified in the Plan after treatments based on a spatial analysis of Aerial Detection Survey data. The estimated snags per acre following treatment are 25 and 38 per acre respectively in drainages 0814 and 1001-1. The potential for firewood cutting is unlikely to substantially impact the snag average numbers given the high abundance of lodgepole pine snags currently present. SMZ's and BMP's are utilized in project design; therefore, as the Plan predicts, the snag resource would not be materially affected in riparian areas. Snag retention guidelines are not required for Forest Plan consistency in harvest units because adequate snags are found in untreated areas. However, project design acknowledges the importance of large, rare snags. No snags would be left in the fuel break treatment areas along the flume due to the purpose and need. Within the Chessman Reservoir units, all snags >20" dbh of species other than lodgepole pine and whitebark pine snags of any size would be retained unless they pose a specific safety concern. In the intermediate harvest unit, there would also be abundant live trees in various size classes retained for snag replacement. Some rare scattered and patches of surviving trees would also be left for snag recruitment in the clearcut areas.

Wildlife

This project would not create the typical mosaic pattern of new openings interspersed with mature forest that has characterized most Forest Service timber projects in lodgepole pine forests over the last

several decades. In this case, the new openings and open-grown forest environments would be concentrated along the Red Mountain flume and around Chessman Reservoir and its associated meadowland. This would localize effects for wildlife rather than spreading them out over a broader area. The habitat configuration created by this proposal would create opportunities for some species and could displace others. Habitat opportunity would shift over a period of years as forest structure were re-established in the treatment units and dead trees in untreated surrounding areas come down.

Although most dead trees are still standing, devoid of needles, they will be falling steadily through the next decade—as beetle-killed trees rot at the base and fall sooner than those killed by fires. At present, surviving green canopy is comprised of several non-pine species (Douglas-fir, subalpine fir, Engelmann spruce, and aspen) scattered individually and in clumps throughout the forest. Conifer regeneration in the understory remains viable, but its distribution and density are highly variable.

In another 5-10 years, the former pine dominated forests will have little or very open-grown canopy (supplied mostly by surviving non-pine species), abundant coarse woody debris, few standing snags, and younger pines and other conifers that have survived the beetles (some of which may reach well up toward the canopy). Dispersion and density of both the overstory and understory will be irregular [see stand descriptions in the Forested Vegetation Report (Project Record)]. In terms of wildlife habitat:

- Movement through the stands will be complicated for large animals (and humans) in many areas because of stacked deadfall;
- Overhead canopy capable of providing effective shade, protection from the elements, and nesting and feeding sites for birds and small mammals will be uncommon;
- Sight distances will be long and hiding cover will be limited and very patchy;
- Opportunities for snag-dependent species will be greatly diminished, while those for animals that make use of downed woody debris (for shelter, nesting, foraging) will proliferate;
- Given the loss of shading and the eventual decline of needle mats, ground level forage and cover in the form of grasses, sedges, forbs, and shrubs will increase on many sites (although overtopping woody debris will suppress it in many);
- Aspen will increase.

In essence, closed-canopied forest with relatively “clean” understories will have been replaced by expansive uncanopied and open-canopied habitat underlain by a mass of woody debris and more robust ground vegetation. In the years that follow, young conifers emerging through the woody debris will proliferate and begin to regenerate the forest in irregular fashion. In sum: wildlife habitat will be evolving over the next several decades.

Figure 11: Typical beetle-impacted lodgepole pine stand south of Chessman Reservoir. Remaining green trees are small pine (less than about 4 inches dbh) and non-pine species. *photo: B.Costain*

The current project has been designed primarily to reduce the quantity of forest fuels in the vicinity of the Red Mountain flume and Chessman Reservoir, rather than to enhance wildlife habitat. In assessing implications of the project for wildlife, I have begun with the existing environmental baseline (ephemeral though it may be)—rather than the one that existed here prior to 2006 or the one expected to be in place in another 5-10 years. In the short-term, immediately after project Implementation, the following local changes relevant to wildlife would become evident in treatment units:

- Hiding and screening cover, which is currently provided by standing dead tree trunks, would be eliminated in treatment units;
- Complexity and density of forest structure provided by dead trees and live conifer regeneration would be substantially reduced in treatment units;
- Some of the screening around key wet sites would be diminished, though not eliminated;
- Woody debris, though not yet abundant in the forest stands, would be greatly reduced in treatment units around Chessman Reservoir and mostly eliminated in the flume corridor;
- Unbroken travel routes for forest wildlife averse to open habitats would be locally disrupted along the flume and around the reservoir;
- The amount of structural edge between dense forest and open habitats would increase;

- As trees (dead and alive), woody debris, and needle mats are removed, ground level vegetation (grasses/sedges, forbs, shrubs) in the treatment units would increase, both in diversity and productivity, improving forage and ground-level cover;
- Aspen, formerly suppressed by conifer completion, would increase;
- Whitebark pine seedlings and saplings would find more favorable growing conditions.

In another 5-10 years, most currently-dead canopy trees in the project area will have fallen, and at that point, the contrast between treatment units and surrounding untreated areas would not be as great as described above. Some differences would be evident, however:

- Most local environments in untreated areas would support abundant coarse woody debris with scattered green overstory trees and variable seedling/sapling conifer regeneration; treatment units would have sparse woody debris, scattered overstory trees, and scattered conifer regeneration;
- Over the long term, hiding and screening cover would be relatively thick in many untreated areas; in cutting units, thinning of incoming regeneration would result in more modest tree densities, although sufficient to provide screening cover and local hiding patches;
- Many parts of the untreated forest would become more difficult for larger animals to move through because of accumulated deadfall; treatment units would be relatively free of obstacles.
- Because of the clutter of woody debris and developing conifer growth, ground vegetation in untreated areas would remain less developed than in treatment units.

For those wildlife issues and species brought forward in this document were due to anticipated impacts from the proposal. Others were not brought forward because they would not be affected in meaningful ways by this proposal. For each of those species, species groups, and habitat components, refer to the Wildlife Background Report and Biological Evaluation (Costain 2013) for brief discussions and analyses as to the rationale for leaving them out of this document. Both Grizzly Bear and Wolverine were brought forward as examples. See next page.

A common thread for not including some is due to the relatively small size and compact nature of the proposal's treatment area, which would render its effects inconsequential to the well-being of wildlife populations in the project area or across the Tenmile watershed.

An additional consideration is that the dominant habitat characteristics that have made this part of the Tenmile drainage attractive to various species in the past have now changed as a result of the MPB outbreak. The contrast between conditions in new treatment units and the surrounding habitats would thus be much less than would have occurred prior to 2006 when the MPB infestation began—and the contrast would be diminished further once a majority of the dead trees have fallen over the next decade.

Grizzly Bear

The grizzly bear has been listed as a *threatened species* in the lower 48 states since 1975. The Flume Chessman project area is 12 miles south of the Grizzly Bear "Distribution Zone" north of U.S. Highway 12. However, a small population of grizzlies appears to be resident south of Highway 12 in the upper Little Blackfoot and Boulder River drainages on the Helena and Beaverhead-Deerlodge NFs. Grizzly bears have not been reported in the project area, although there have been a few unconfirmed reports in the upper Lump Gulch/Quartz Creek drainage just east and southeast of Chessman Reservoir. Over the last 15 years, credible reports have also come in from the upper Little Blackfoot drainage to the west and the Boulder River watershed on the Beaverhead-Deerlodge NF just to the south. While reports are infrequent and none have been verified (by photos, hair/scat analysis, observation by bear biologists), it seems likely that grizzlies range through parts of the upper Tenmile drainage on occasion.

Grizzlies, while making extensive use of forest cover, generally prefer to operate in a landscape with a variety of habitat formations ranging from dense interior forest to open meadowlands (Dood et al. 2006, p. 18). They are especially drawn to areas with an abundance of deciduous shrubs in both forested and unforested habitats. Whitebark pine seeds are an important food source where they occur, but this has not been a factor in the project area in recent years as only seedling/sapling whitebark pine have been present. Productive, often wet habitats around Chessman Reservoir and the extensive meadows south of there provide the best foraging habitat for grizzly bears in the project area (as they do for a number of other wildlife species). The proposal would specifically avoid adversely modifying these sites and other components of potential use to bears, such as whitebark pine and aspen. Enhancing the quality of these features is part of project design.

In addition to the effects of habitat manipulation, bear-human encounters during project implementation are a possibility. The most likely scenario is that any grizzly bear moving through the area while project operations were active would simply detour around the focus of activity and avoid the area. Habitat components in project area treatment units are not so attractive that bears would feel compelled to move in on them in the midst of high-profile human activity; nor is the Chessman ridge the only travel route through the area. Given the broad availability of suitable habitat features and the rarity of grizzlies in this area, the potential for bear-human confrontations is very low.

The size and configuration of new openings and open forest anticipated under the proposal are compatible with what is normally tolerated and used by grizzlies, and in fact, the new juxtaposition of forest cover and open habitat would be useful to them. Cover would remain abundant in surrounding forest for another 10 years, after which, the absence of cover would become the dominant aspect of both treated and untreated areas alike. All key habitat components that might focus grizzly bear activity (whitebark pine, aspen, productive wet sites, preferred shrub patches) would be protected under this proposal. It is highly unlikely that new treatment units would attract more human activity: the potential for increased human-bear encounters would be extremely low. None have occurred in the vicinity of the project area over the past several decades in spite of human activity associated with them (including the city of Helena flume project, which is similar to this proposal.

Wolverine

The North American wolverine is currently classified as a "sensitive species" in Forest Service Region 1. In February 2013, the USFWS "proposed" the wolverine for listing under the Endangered Species Act ESA). A decision as to whether the wolverine will actually be listed is due out within the year; and in the meantime, it will be analyzed here as a sensitive species.

Winter tracking surveys (by Wild Things Unlimited of Bozeman) in the upper Little Blackfoot drainage, along the Continental Divide, and along the western edge of the Tenmile drainage, coupled with DNA analysis (by the FS Rocky Mtn. Research Station, Missoula) have consistently identified 2 resident male wolverines over the past few years [see Gehman et al. 2006-2010; Pilgrim 2007-2010]. These animals range widely across the entire length of the Divide landscape from the northern rim of the Little Blackfoot drainage around Roundtop Mountain and Meyers Hill to the upper reaches of the Boulder River watershed. And they probably pass through the Flume Chessman project area on occasion. There are no particular habitat components in the project area that would attract and hold wolverines, although the animals would certainly take advantage of any carrion or other food source they happened upon there.

No breeding activity has been detected in the greater Divide landscape, but field observation by HNF wildlife biologists suggests that there may be a few potential natal denning sites in the area—the nearest ones to the project area being on the upper slopes of Red Mountain a couple miles to the south and around Lee Mountain across the drainage to the west. Neither of these has been identified as a denning area by the Northern Region wolverine habitat model, but field reconnaissance suggests that they might possibly serve the purpose. The nearest *known* denning areas are in the Scapegoat Wilderness on the Lincoln RD 50 miles to the northwest and in the northern Big Belt Range 35 miles to the northeast.

Wolverines are habitat generalists and would not be adversely affected by the treatment units proposed around the Red Mountain flume and Chessman Reservoir. While primary roads may serve to fragment wolverine habitat to an extent, new openings such as those proposed here would not have that effect. The project is not in a potential natal denning area and would have no effect on the ability of wolverines to breed and raise young. The project would not facilitate trapper access to anywhere. Impacts of the project would not be significant.

The following wildlife species, habitats, and habitat components were determined to have potential impacts from this proposal and therefore are included in this document.

- Riparian Habitats
- Travel Corridors and Linkage Zones
- Snags and Woody Debris
- Elk Hunting Season Security
- Elk Summer Range
- Canada Lynx
- Northern Goshawk

Riparian Habitats

While the traditional definition of "riparian" refers to a site "on the bank of a river or other body of water" [Random House Dictionary], ecologists employ a modified and much broader definition that encompasses wet terrestrial habitats associated with rivers, creeks, ponds, lakes, springs, swamps, bogs, seeps, and perched water tables (which may not involve any open water at all). Riparian areas are widely distributed but often highly localized. Their high vegetative (and often, structural) diversity, elevated productivity, water-induced microclimate, and unique vegetation relative to surrounding areas make them attractive to a disproportionate number of wildlife species (Thomas 1979, p. 41-43).

The wildlife species served by riparian areas are diverse. Riparian zones provide more breeding habitat for birds than any other kind of habitat association in North America (Kauffman et al. 2000). Amphibians require aquatic habitat and adjacent riparian zones for part of their life cycle. Some mammalian species such as mink, beaver, muskrats, and water voles are tied to aquatic and riparian habitats. A number of other small mammals are drawn to the cool, humid microclimate of riparian environments. Elk, deer, moose, foxes, bears, and mountain lions, though they spend much of their time in drier upland habitats, are sooner or later drawn to riparian areas—for water, forage or prey, cover, or thermal relief. Linear riparian zones, such as those along streams and rivers serve as travel corridors for many species.

No-Action

The no-action alternative would allow natural processes to play out along the flume and around the reservoir and its adjoining meadows. As beetle-killed trees fall, this condition will evolve.

Many riparian areas in the project area are small, largely subirrigated sites (*Figure 11*). A few hold pools of standing water into summer or support small trickling stream flow. The sites are interspersed with more extensive upland forest—primarily lodgepole pine.

Figure 12: A forested riparian site in Unit #15. In Nov. 2010 the draw was alternately wet and dry along its length. Vegetation is diverse and robust. Conifers are green Engelmann spruce and subalpine fir, in addition to dead lodgepole pine. *photo: B.Costain.*

The larger sites tend to alternate wet and drier patches, with the wet patches dominated by sedges and riparian forbs. The drier patches support bluejoint and other mesic vegetation and provide fertile substrate for colonizing conifers, aspen, and shrubs (*Figures 9, 11*). Virtually all of the larger lodgepole pine associated with these sites are now dead; the Engelmann spruce, subalpine fir, and aspen remain viable. Most sites are quite wet in spring and early summer, with patches of standing water here and there, but they partially dry out through the summer.

Figure 13: A broad wet/mesic meadow—an arm of the big Chessman meadow to the west —situated at the south end of unit #14. This is the largest "riparian area" in the treatment units. It supports healthy aspen and is a key site for elk and deer. Lodgepole pine, dead and alive, is scattered across the area on patches of drier ground. *photo: B.Costain.*

Most of the northern and eastern shoreline of Chessman Reservoir does not support a productive riparian zone. The transition from upland mesic vegetation to the water is fairly abrupt, and the shoreline is generally gravelly rather than marshy. The western shore features a few small riparian patches, but it is on the south end where the primary riparian habitat is located. Here, water flows into the reservoir through a large meadow complex that exemplifies the kind of riparian habitat that used to occupy this entire upper branch of Beaver Creek before it was inundated. The meadow complex is the largest riparian area in the project area (*Figure ??*).

Figure 14: The big meadow complex south of Chessman Reservoir, bordered by treatment units #10, #14, #15. At the time of this photo was taken (Nov. 2010), the subirrigated meadows were alternately wet and mesic (moderately dry). *photo: B.Costain.*

The meadow is bordered by parts of 3 treatment units (#10, #14, and #15), which have been delineated to avoid riparian habitat of the main meadow but which overlap some arms of the meadow that spread out into the surrounding forest. These habitats differ from those in the big meadow in that they are more entwined with forest habitat, forming a structurally intricate cover/forage complex particularly useful to large herbivores, but also to riparian and forest birds, and a number of small mammals. There is enough dry ground throughout these sites to support a variety of conifers, including Engelmann spruce, subalpine fir, Rocky Mountain and common juniper, and lodgepole pine. Mature aspen is also present with most young aspen being killed or severely retarded by browsing from elk, moose, and deer.

Figure 15: Forest ecotone on the east edge of the big meadow—southwest corner of unit #14. The area is alternately boggy and dry: forest conifers and common juniper grow on the dry patches; sedges, moss, and riparian forbs on the wet sites. Many game trails are present. *photo: B.Costain.*

Under a no-action scenario, the relationship between forest cover and local riparian areas would remain more or less as it now for another couple years, with an abundance of standing dead lodgepole pine close at hand, a good representation of green Engelmann spruce and subalpine fir, and some woody debris scattered about. But soon, the environment in and around forested riparian sites would shift noticeably as the lodgepole pine trees, which provide the bulk of the associated forest structure, proceeded to fall and accumulate as woody debris.

The absence of standing cover would change the way in which some of the more wide-ranging wildlife species approached and made use of these areas—elk, deer, moose, and black bears among them. In addition, without most of the surrounding tree cover and shade, the microclimate of the wet sites would shift, affecting resident small mammals, birds, and amphibians. Changes would include loss of perch and nest sites, changes in ground vegetation, accelerated water evaporation in summer, increased water temperature, etc. (Thomas et al. 1979, p. 46). The downed trees would provide a certain degree of structural complexity useful to small mammals, amphibians, and some birds, and if substantial enough, larger mammals (concealment for bedded animals, for example). An abundance of coarse woody debris would also serve as barriers discouraging cattle—while not numerous in this area—from getting into the wet sites.

Proposal

As for the Red Mountain flume treatments: the string of units that follows the flume westward from Chessman Reservoir runs far enough south of Beaver Creek as to leave those riparian zones undisturbed—with the exception of where the Creek exits on the west side of the Reservoir and abuts a wet meadow there. As for the flume, it has been built across a series of moderate-steep upland slopes and, except for the area just west of Chessman Reservoir, it is not associated with any substantive riparian habitats. Beyond the point where it enters the reservoir, all of the steams that the flume crosses are steep and narrow. Treatment units along the flume would have minimal impact on riparian habitat. Any flowing stream within the treatment area would be subject to Montana Streamside Management Zone (SMZ) Rules (see MDSL 1994).

With regard to forested riparian sites around Chessman Reservoir and its meadow complex, the proposal would involve three effects different than what would occur by leaving dead trees to fall on their own: (1) the loss of the cover provided by standing dead trees that are associated with riparian sites would occur quickly through harvest rather than gradually over 5-10 years; (2) the bulk of the deadfall in surrounding areas would be removed; and (3) there would be some potential for ground disturbance from equipment used in harvest operations.

The sudden loss of cover is likely to be more disruptive to small wildlife species dependent on riparian areas than if it were allowed to pass away by natural means. But, the end result after a year or two would be essentially the same. The removal of all deadfall would be a more substantial problem for a wider variety of species: therefore, it would be mitigated by retaining a margin of undisturbed snags and deadfall in and around the margins of riparian sites (see *Wildlife Mitigation and /Design Elements*. Green trees of all sizes associated with riparian sites would also be retained (mostly subalpine fir, Engelmann spruce, and aspen. Exceptions would be (1) where leaving conifers would suppress the

development of aspen and (2) where retention of particular trees or logs subverted the basic intent of the project to minimize fire intensity and danger to the flume and reservoir. As per requirements of the Soils and Hydrology sections, mechanized equipment would not be allowed to operate in riparian areas—with a few potential exceptions involving passage over frozen ground in winter. This would minimize physical disturbance to the sites.

As a result of proposed mitigation and design elements, disruption of project area riparian sites as wildlife habitat would not be significant. Anticipated changes in terms of habitat viability would be similar to those that would occur in the absence of the proposal.

Cumulative Effects

The cumulative effects analysis area for riparian habitats is the Flume Chessman Project Area (4,760 acres). In addition to proposed Forest Service units, this area also includes those portions of the flume already treated by the city of Helena.

Because the riparian sites with potential to influenced by the project are relatively small and localized, the project area appeared to provide the right scale for looking at the needs of animals moving between riparian areas throughout the course of a season.

In the past, Forest Service timber harvest and fuels treatment activities have been modest, and virtually none have impacted riparian habitat. This activity has affected a total of 467 acres from 1960 to 2013. Timber harvest and salvage operations have also occurred on private inholdings within the project area over the past 50 years: almost all of these operations have been in the west end of the project area toward the town of Rimini on Tenmile Creek where private holdings are concentrated.

The only other past activity relevant to riparian sites in this area was the revision of the Clancy-Unionville grazing allotment plan in 2006. Although the plan adjusted grazing numbers and seasons around the allotment, it produced no changes that altered the potential for grazing pressure on project area riparian sites—mostly around Chessman Reservoir. Given the relatively low stocking numbers in this part of the allotment, the potential for livestock impacts remains modest.

Present and ongoing activities with some potential to influence local riparian resources the Clancy-Unionville Vegetation project (which affects only the far eastern tip of the project area), the HNF hazardous tree removal project (directed at road corridors, campgrounds, and administrative sites), timber harvest on private and other non-Forest lands, noxious weed spraying, grazing on public and private lands, creation of a firebreak by the city of Helena along the portion of the flume on private lands, and revision of management plans for the Big Buffalo and Frohner grazing allotments.

Reasonably foreseeable actions with some marginal implications for riparian resources are the Divide Travel Plan (which may affect the status of a few primitive roads in the project area) and the reissuance of the permit for the city of Helena water system (which will extend the right-of-way for future flume maintenance to 100 ft. on each side of the structure).

The sum of past and ongoing cumulative effects has not been of a great enough magnitude to interfere with the ability of wildlife to seek out and make use of productive riparian areas throughout the project area. Retention of current conditions and trends in the project area under the no-action would not add to these human generated effects on riparian sites or to reasonably foreseeable actions in a way that would imperil the viability of local wildlife populations or violate Forest Plan standards and guidelines.

The proposal would not add to past, on-going, and reasonably foreseeable cumulative effects in a way that would significantly alter the ability of riparian sites to support current wildlife populations or those expected to evolve with changes resulting from the mountain pine beetle outbreak.

Forest Plan Consistency

The overarching standard for riparian areas as wildlife habitat is riparian standard #9 [*HFP,* p. II/35], which states that "[r]iparian areas will be managed to be compatible with dependent wildlife species". Other standards relevant to wildlife are big game standard 6 (which includes the *Montana Cooperative Elk-Logging Study* recommendation to maintain the integrity of moist summer range sites for elk), big game standard 10 (which requires maintaining adequate browse for moose—often riparian vegetation), and threatened/endangered species standard 2 (which requires maintaining the integrity of grizzly bear habitat components—often riparian). Management areas H-1 and H-2, which cover virtually all of the treatment units, both have a requirement to "maintain and/or enhance the diversity of wildlife habitat"—which is directly applicable to riparian sites.

Neither alternative run afoul of any of the *Forest Plan* wildlife standards that either directly or indirectly relate to riparian areas.

Travel Corridors and Linkage Zones

Corridors

While the entire project area and most treatment units within it are traversed by a number of wide-ranging wildlife species throughout the course of the year, it is the area around Chessman Reservoir that receives enough regular movement to qualify as a bonafide travel or movement corridor. The issue is whether removal of the standing dead trees and woody debris would eliminate this area as a viable travelway for wildlife species in the immediate future and over the long-term—and would it do so to a greater extent than would allowing trees to fall of their own accord.

No-Action

No-action would allow natural processes to play out along the flume and around the reservoir and its adjoining meadows.

The primary local connectivity in the project area passes through the predominantly forested region around Chessman Reservoir. MFWP has identified it as an area with relatively low levels of human impact that helps provide wildlife linkage between the Lazyman Roadless Area to the north and the Occidental Plateau to the south. A variety of animals move through here in the course of the season. Many prefer to move under forest cover—elk, mule deer, moose, black bears, mountain lions, marten,

porcupines—although most can navigate a more open environment as long as human interference is minimal.

Under the no-action alternative, the current status of the movement corridor would remain relatively intact for perhaps another 3-5 years. Because beetle-killed lodgepole pine dominate the corridor, often in nearly pure stands, trees will continue to fall, and hiding cover, and then screening cover, will disappear through the next decade. At the same time, coarse woody debris will pile up, providing some cover for smaller animals—and in some cases for larger animals—but requiring more convoluted pathways to navigate the area. As post-fire environments in lodgepole pine stands elsewhere on the HNF have demonstrated (the Warm Springs burn in the Elkhorn Range, for example), stands of moderate-high density can often accumulate enough deadfall to block movement by larger animals and force them to seek out diversionary routes.

In spite of the scarcity of mature forest cover, the Chessman area would continue to function as a viable travel corridor for most species that currently use it. Elk, deer, black bears, moose, wolverines, and other such species often make use of uncanopied habitats full of deadfall, finding cover as needed in the accumulated debris, regenerating conifers, and patches of surviving mature trees (personal observation). Forest obligates, such as marten, would find the new condition problematic, although given the deadfall density, they would probably be able to move through. At the same time, the other characteristics that make the area favorable as a movement corridor would remain in place.

Once the bulk of the overstory trees came down, conifer regeneration would pick up, slowly restoring forest cover. Travel routes through the Chessman area would remain irregular for several decades until accumulated deadfall has settled and decomposed.

The Flume Chessman project area lies within what has been characterized as the "Continental Divide linkage zone" (Servheen et al. 2001). The broad ridge between the Tenmile and Lump Gulch/Buffalo Creek drainages in the vicinity of Chessman Reservoir is a segment of the one of the linkage zone pathways through the Divide landscape. While it functions primarily as a conduit for daily and seasonal movement for locally based species, it also provides a relatively undisturbed route for animals making long-distance moves. The characteristics that make it useful as a local corridor also apply to its function as part of the Continental Divide linkage zone.

The effects of the no-action alternative on the use of this area as part of a linkage zone would be the same as those discussed above for the local movement corridor. Because large blocks of forest cover are soon to be lost across the entire Divide linkage zone due to the MPB infestation will change the way different species navigate the area around Chessman Reservoir apply to the entire Divide landscape.

Proposal

The proposal would treat approximately 332 acres in the area around Chessman Reservoir that currently serves as the main movement corridor through the project area. All dead trees and the bulk of the woody debris would be removed from a broad swath around the reservoir and around some of the large meadow to the south, leaving open-grown forest of widely varying density, (depending on the

distribution of green trees that have survived the beetles). The forest would be allowed to regenerate but would be managed for relatively wide spacing of overstory trees and no effective ladder fuels.

Immediately following harvest, the local connectivity around the Chessman travel corridor would present a new unforested environment. The openings would extend along the ridge, north and south, for about 6,150 ft on the east side of the reservoir and about 3,950 ft on the west side. Local patches of cover would remain dispersed throughout the treated units, provided by groups of surviving green trees (Douglas-fir, subalpine fir, Engelmann spruce, aspen, younger lodgepole pine). Many of these cover patches would be associated with riparian sites.

The new openings would be flanked by stands of mature dead trees. Many animals moving through this area (elk, deer, coyotes, foxes, bobcats) would cross the openings—the more wary crossing at night or staying close to the edges. Other species (lynx, marten, black bears) are more likely to move through the timber along the edges. The main problem for elk and deer would come during the hunting season when they would have more reason to stay in cover. Nonetheless, the area would continue to function as a viable travelway.

After 5-10 years, when most of the dead trees in surrounding areas have fallen and stacked up as woody debris, the treatment units, lacking deadfall, would prove an easier travel route for some species. The untreated areas, though now lacking hiding cover, would still provide some local cover by way of the stacked deadfall and may provide a more attractive travel option for other species. In any event, with the other components that make the Chessman area an effective travel zone still intact, the area would continue to function as such.

Over the long-term, with mature forests regenerated in both treated and untreated areas and coarse woody debris having settled and disintegrated to a certain degree, the primary difference between the two would be in the density of the new forests. Forest stands in the treatment units would have relatively open overstories, with trees spaced 12-15 ft apart. Understory growth would be irregular and would be managed to prevent the development of ladder fuels that could carry fire up into the forest canopy. Forage quality in the open stands would be better than in the denser surrounding stands. Experience in the Belt Range has demonstrated that elk and deer will make considerably more use of thinned, open-grown pine stands with robust ground cover than of denser unthinned stands [Bull-Sweats Vegetation Management Project, HNF]. Surrounding untreated stands will have characteristics as described for the no-action alternative—hiding cover, residual woody debris, lesser quality forage.

Both in the short-term and over the long-term, changes in the Chessman Reservoir movement corridor generated by the proposal, would not significantly impair the effectiveness of wildlife habitat connectivity through the area.

In the short-term, characteristics that influence the movement patterns of species making use of the Chessman travel corridor on a daily or seasonal basis would also apply to those making long distance movements connecting with the Divide linkage zone. Over the long-term, the juxtaposition of dense and more open forest stands in the Chessman area should prove conducive to most species migrating, dispersing, or making other long-distances moves through the Divide linkage zone. The mosaic quality

of linkage zone habitat is cited by a number of researchers as a positive feature of long-distance habitat linkages (Craighead et al. 2001; Walker and Craighead 1997; Servheen et al. 2003)

Cumulative Effects

The cumulative effects analysis area for travel corridor and linkage zone habitat is a Combination Area, which takes in an area of 136,105 acres astride the Continental Divide south of U.S. Highway 12.

Past Forest Service timber harvest and fuels treatments have been fairly active over the past few decades, creating a widespread pattern of early-seral, mid-seral, and late-seral forest habitats. Some cutting/burning units have been large enough, prior to the development of screening saplings, to be beyond the comfort zone of species such as elk, mule deer, black bears, and mountain lions, causing them to divert movement around the edges. But most are small enough to contribute to the kind of cover/forage mosaics that are cited as positive features of linkage zones for most large/mid-sized species. In terms of local forest corridors, some of these new openings have cut traditional linkages between habitats within daily and seasonal home ranges of many species. While the effect is temporary, it may span several decades for species highly dependent on mature forest habitat (marten, fishers, red squirrels). The linkages are not re-established for most species until forest regeneration has reached at least the mid-sized sapling stage.

The table below, summarizes timber harvest and fuels treatment activity on HNF land in the Combination Area since 1960.

All of this activity has opened up forest habitat to one degree or another, with wide-open early seral habitat following timber harvest and open-grown forest of variable structure typically following fuels treatments. In almost all cases, previously established hiding cover has disappeared; and in the case of timber harvest and the more open-habitat fuels treatments, local movement corridors for forest-dependent species have been disrupted. At the same time, generalist species moving through the linkage zone have often found a useful mosaic of cover and forage. Most areas harvested prior to 1990 have now re-established hiding cover or something close to it. True interior forest conditions have probably been re-established only in sites treated prior to 1970. The no-action would retain the current distribution of early-seral habitat. Functionally, in terms of its appeal to forest centered species, this would include most of the area treated since 1990. The proposal would add 490 acres to this total.

Table 22: Harvest and fuels treatment activity in the Combination Area (136,105 acres) since 1960.

Decade	Timber Harvest acres	Fuels Treatment acres	Dominant vegetation structure in regeneration harvest units at present *
1960 – 1969	26	17	young mature / pole-sized conifer stand
1970 – 1979	1,602	940	pole-sized conifer stand
1980 – 1989	1,195	866	mid to large-sized sapling conifers
1990 – 1999	477	1,551	small to mid-sized sapling conifers
2000 – 2009	749	3,541	seedling conifers / grasses & forbs
2010 – 2013	888	3,242	early seral grasses & forbs *or* open forest
53-year Total	4937	10,157	

* The structural status of fuels treatment units is highly variable. The most common structure in these units in these treatment units is "open forest"—the size of the trees depending on those in the initial stand.

Timber harvest and salvage operations have also occurred on numerous private inholdings in the project area, many of them in the last 5-7 years since the advent of the mountain pine beetle outbreak.

Numerous projects that have occurred throughout the Combination Area over the past few decades have temporarily interfered with animal movement patterns along established corridors due to the concentration of human activity. Once the activity is over, the linkages have been re-established—except in cases where some kind of permanent structure or on-going focus of human activity has remained. These activities include a variety of road maintenance and repair projects, hazardous mine opening closures, erosion control projects, hazardous tree removal along roads and at recreation sites, authorization to haul logs on Forest roads, hiking trail construction, National Guard helicopter training, recreation events, mining exploration, and construction or short access roads to private inholdings. In other cases, permits to continue ongoing activity, some of which has disrupted habitat linkage, have been reissued: most prominently, private road use permits and reauthorization of grazing allotments.

The city of Helena's recent clearing of dead trees from around segments of the Red Mountain Flume that cross private land essentially doubles the local effect of what the HNF is proposing for the National Forest section of the flume (about 160 acres).

The most influential natural events in recent years that have shifted the nature of habitat connectivity are the MacDonald Pass fire (2009) and the mountain pine beetle outbreak (beginning around 2006). The pine beetle outbreak has already had an appreciable effect on the character of linkage habitat by removing much of the canopy foliage from thousands of acres of pine stands. But it continues to be an on-going influence, with more habitat alteration in the works. In the past, prior to human-generated forest clearing, these are the kinds of natural changes to which species were adapted—somewhat different in detail compared to clearcuts and prescribed burns, but not entirely foreign to native species.

Present and ongoing activities with some potential to disrupt wildlife movement patterns, at least temporarily,include occupancy of 12 private recreation residences on HNF land; maintenance of 3 campgrounds, 2 day use areas, 5 trailheads, and a rental cabin; road maintenance projects; trail maintenance projects; Prickly Pear Sportsmen's target range; livestock on grazing allotments; and the Clancy-Unionville vegetation project on both Forest and BLM lands; maintenance along U.S. Highway 12, which continues to be a primary problem for animals moving north and south through the linkage zone as well as for many moving within and between seasonal ranges.

Three reasonably foreseeable actions with substantial implications for wildlife movement are (1) the Divide Travel Plan, which proposes a variety of changes to current vehicle routes (open roads being one of the primary disruptors of wildlife movement); (2) the Telegraph Vegetation Project (which would remove dead trees and thin young conifer stands on >6,000 acres just west of the Continental Divide); and (3) upgrading of the Rimini Road in the bottom of Tenmile Creek (which would transform a low-moderate speed gravel road, which follows and intersects a number of wildlife movement routes) into a paved Forest highway.

The sum of past and ongoing cumulative effects have impacted movement within daily, seasonal, and year-round home ranges of resident wildlife. Regeneration timber harvest and some fuels treatments

have been impediments primarily for forest wildlife. Such breaks in forest cover take somewhere between 25 and 50 years to regain forest corridor function (depending on the wildlife species in question). Open roads and a variety of other human developments and activities have also served to block and divert local travelways. The sum of these disruptions, however, has not been sufficient to imperil the viability of local wildlife populations or violate Forest Plan standards and guidelines. Nor have they been sufficient to block long range movements by key wildlife species: regular, successful movement by lynx, wolverines, wolves, grizzly bears, elk, and other species has been documented in recent years. Retention of current conditions and trends around the Red Mountain flume and Chessman Reservoir under the no-action would not add significantly to these human generated effects or to the changes expected as a result of foreseeable actions and the aftermath of the mountain pine beetle outbreak.

The removal of dead trees from 490 acres under the proposal would not add to past, on-going, and reasonably foreseeable cumulative effects in a way that would significantly alter the functional capacity of existing wildlife movement corridors or the Divide linkage zone. The substantial habitat changes expected with the demise of mature pine forests killed by mountain pine beetles would not be meaningfully magnified by this project going forward.

Forest Plan Consistency

The only *Forest Plan* guidance that directly addresses movement corridors is in the *Montana Cooperative Elk-Logging Study* recommendations (which are incorporated into the *Plan* via big game standard 6). These include a recommendation to provide for elk security by maintaining an open road system that minimizes impacts on elk travel routes—avoiding saddles and low divides that serve as crossing routes for elk, maintaining forest cover where roads intersect elk travel routes, closing timber sale roads that interfere with elk movement patterns to vehicle use after timber sales, and so on.

The proposal would construct approximately 0.5 mile of low-grade road in the Chessman travel corridor. The road would not be open to public vehicle use and would be obliterated at project's end. It would, along with other project operations, temporarily discourage elk and several other species from using that part of the movement corridor whenever project operations were active. Most wildlife movement through the area would occur at night. However, the road would not serve as a permanent open conduit for hunters and other vehicle traffic that would threaten the viability of the travel corridor. It would comply with the standard.

Snags and Woody Debris

The basic logistics of snags as silvicultural components are covered in detail in the *Forested Vegetation Report* (p. 5, 15-16, 40-42, 51, 58-59, 66) [Project Record]. But because dead trees, standing and down, are such a dominant feature of the project area and a key resource for numerous wildlife species, their role as wildlife habitat needs to be examined as well.

Tree decay is an ecological function that creates key habitat elements—snags and logs—for wildlife (Rose et al. 2001). Living trees with decay, hollow trees, dead trees, and logs are an integral part of healthy forest communities and key elements in maintaining wildlife diversity (Bull et al. 1997). Snags

provide the primary substrate for the cavities that many birds and arboreal mammals require for an array of basic life functions (Thomas 1979, p.60).

Most woodpeckers excavate a new cavity each year (Bull et al. 1997), thereby generating a continuous resource for secondary cavity users—species unable to produce their own cavities. These include several species of owls, myotis bats, kestrels, wrens, tree swallows, bluebirds, marten, red squirrels, and flying squirrels, among others.

Snags continue to be important to wildlife once they fall and become logs. Logs provide foraging sites, hiding and thermal cover, denning sites, nesting sites, and travel conduits for small animals, such as chipmunks, pack rats, deer mice, weasels, marten, grouse, toads, and salamanders (Rose et al. 2001). Larger animals, such as bears, forage for invertebrates in logs. Fishers use large logs as den sites; lynx typically select dense patches of downed trees for denning.

Mixed coniferous forests (such as the Douglas-fir/ lodgepole pine in parts of the Flume Chessman project area) often experience a mixed severity fire regime, which results in considerable variability in snag density. Cool lodgepole pine and spruce/fir forests (as dominate the upper elevation parts of the project area) generally experience infrequent stand-replacing fires, which generate periodic snag pulses (Lyon 1977).

The current mountain pine beetle outbreak has produced an environment similar, but not identical to what would have followed a stand-replacing fire. Among the differences are the Forest-wide magnitude of the event, the retention of forest understory vegetation, and the expected timing of the overstory trees falling. In the aftermath of stand-replacing fires, a substantial portion of the dead lodgepole pine trees may remain standing for many years, sometimes decades, supported by their dead but intact root systems. Beetle-killed trees, on the other hand, soon break off at the base of the trunk and are transformed into woody debris in a matter of 5-10 years. The make-up of the wildlife community at any given time will depend, at least in part, on the proportion of standing dead trees to those down.

No-Action

The no-action would, for the time being, preserve the status quo with regard to snags and woody debris along the flume and around reservoir and its adjoining meadows. But as natural processes to play out over the next 5-10 years the structural configuration of the snag/woody debris resource and of the forest as a whole will evolve rapidly, irrespective of the fact that no new action has been taken.

Dead trees are currently the dominant feature of conifer forests in the Flume Chessman project area. Prior to the mountain pine beetle irruption in 2006-2007, project area forests supported relatively few snags—just enough to meet the *Forest Plan* standard of at least 2 snags/acre in areas outside riparian zones (*HFP,* p. II/21). In 2009, at the height of the mountain pine beetle outbreak, aerial detection surveys determined that 95% of the project area (4,497 acres) and 75% of the combination area (102,149 acres) were actively infested with mountain pine beetles. Currently, the minimum number of medium-large sized standing dead trees estimated for the Beaver Creek drainage is 40 snags/acre; the estimate for the Buffalo Creek drainage is 25 snags/acre [*Forested Vegetation Report,* p. 32, 36]. The average for the 2 drainages combined is 32.5 snags/acre.

Habitat opportunities for wildlife species able to take advantage of standing snags have proliferated since 2006. Nesting opportunities for pileated woodpeckers are uncommon in the small diameter lodgepole pine forests but feeding opportunities abound. Because most woodpeckers will feed and nest in dead trees regardless of overstory conditions, they are able to take full advantage of the new environment. However, some of the species that previously occupied these forests when the live canopy was overhead—white-breasted nuthatches, creepers, ruby-crowned kinglets, red squirrels—have now become rare. A few of the more versatile species, such as mountain chickadees, red-breasted nuthatches, robins, juncos, and Townsend's solitaires, continue to occupy the stands. Where green understory trees remain , these species are more common and open-forest species such as chipping sparrows are beginning to move in.

Over the next 5-10 years, habitat opportunities for species adapted to coarse woody debris will increase as opportunities for species requiring standing snags decline—and, as always, populations of the more generalist species will remain fairly steady. In general, smaller ground-dwelling species, such as chipmunks, bushy-tailed woodrats, weasels, snowshoe hares, cottontails, foxes, and grouse, will find shelter and food in the accumulated woody debris, while larger species such as elk, deer, black bears, and moose will have difficulty traversing the maze of obstacles. Cavity dwellers will, for the most part, be bereft of suitable nesting/denning substrate.

The No-Action Alternative would exceed *Forest Plan* standards for snags/acre within third order drainages to an exorbitant degree; and it would far exceed average snag densities shown in *Estimates of Snag Densities for Eastside Forests in the Northern Region* (Bollenbacher et al. 2008).

Figure 16: Lodgepole pine stands in Unit #14. The canopy is 90% dead. Almost no young conifers are present in the understory; but the robust ground cover of bluejoint indicates a moderately productive site (Pfister et al. 1977, p. 88) with good potential for regeneration. There is little deadfall in this Nov. 2010 photo, and little more had accumulated as of April 2013. *photo: B.Costain.*

Figure 17: Mature lodgepole pine stands east of Chessman Reservoir. The overstory is more than 90% dead. A modicum of multi-sized regeneration is coming along in the understory, which provides for increased wildlife diversity. Virtually no big snags are down as of this photo (Nov. 2010). There was a little more deadfall as of spring 2013. *photo: B.Costain.*

Proposal

The proposal would treat 490 acres—removing all dead trees from around the Red Mountain flume and most dead trees from around Chessman Reservoir and its meadows (retaining riparian snags and large non-lodgepole pine snags wherever they occur). The table below summarizes the scope of the snag resource in the combined Beaver Creek and Buffalo Creek drainages and the projected loss of snags in the proposal. Since project area forests supported few snags prior to the beetle outbreak in 2006, we assume that the estimate of "beetle-killed trees" is more or less synonymous with the total number of snags in the area.

Table 23. Numbers of snags expected in the combined Beaver Creek and Buffalo Creek drainages after implementation of the Proposal.

Current number of beetle-killed trees	877,815
Average snags/acre	32.5
Number of snags likely to be cut	26,605
Number of beetle-killed trees remaining	851,210
Average snags/acre remaining	32.0
Forest Plan minimum snags/acre standard	2

The proposal would subtract 3% of the standing snags from the Beaver and Buffalo Creek drainages. This would reduce average snags/acre in the 2 combined drainages by about ½ of 1%—from 32.5 to 32.0 snags/acre. The result is well above the minimum 2 snags/acre required by the *Forest Plan* and well in excess of the 9.2 average snags/acre larger than 10 inches dbh in lodgepole pine stands documented in *Estimates of Snag Densities for Eastside Forests in the Northern Region* (Bollenbacher et al. 2008, p. 38). In terms of drainage-wide impact, the effects of this proposal would be inconsequential.

Locally, dependent species would be immediately displaced from the 490 acre treatment area. Over the long-term, species adapted to accumulations of coarse woody debris would be excluded as well. This displacement would not be significant in terms of population viability for any species either within the Combination Area or the local Project Area.

Cumulative Effects

The cumulative effects analysis area for gauging effects on the dead tree resource is the project area. As discussed in the *Forest Vegetation Report* (p. 47), this is appropriate analysis area for cumulative effects since the small size of the treatment area yields trends that can't be measured at larger scales.

Primary activities eliminating snags across the landscape are (1) timber harvest and fuels treatment activities, which while leaving some snags behind, often remove more than were originally present and (2) public firewood cutting along open roads. Firewood cutting is a constant: it removes almost all large snags from open road corridors regardless of any other environmental factors and is thus a function of open road density. In the Flume Chessman project area, timber harvest/ fuels activities have occurred at a relatively low level over the past 50 years as displayed on the next table. The proposal would essentially double this total. But while past harvest activity has eliminated snags from an environment with relatively few dead trees, the proposal would now subtract them from a vast sea of dead trees. That is, the number of snags remaining would be well in excess of what would normally be required for local snag-dependent wildlife associations.

Table 24: Timber harvest and fuels treatment activity in the Project Area (4,760 acres) since 1960.

	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2013	Total
Timber Harvest Acres	6	19	22	10	41	43	141
Fuels Treatment Acres	0	15	48	140	0	123	326

Ongoing activities with some potential to remove snags include (1) the Clancy-Unionville Vegetation Project, which leaks into the Project Area on its eastern edge (2) the HNF roadside hazardous tree removal project, which affects part of the Beaver Creek Road corridor, and (3) regular maintenance of the Red Mountain flume, which requires removal of snags likely to endanger the flume structure.

There are no reasonably foreseeable activities in the Project Area that are likely to have any meaningful influence on the dead tree resource.

The effect of human activities has been modest in the project area. There is little ongoing or foreseeable activity in the project area that would appreciably add to the effect of these past actions—including the no-action alternative. The MPB outbreak has added so many snags to project area wildlife habitats that the cumulative effect of past, ongoing, and foreseeable snag removal has been minimized. Over the long-term, virtually all of these snags will fall before the regenerating forest is mature enough to begin producing new snags of any stature. As a result, there will be a period of several years when large dead trees are rare in these lodgepole pine dominated forests.

While the removal of 490 acres in the proposal of dead trees would essentially double the acreage of what has occurred in the project area since 1960, the relative impact in terms of the snag resource left for local wildlife would be minor. The remaining abundance of dead trees in the project area would produce a result for snag-dependent wildlife similar to deferring action.

Forest Plan Consistency

The no-action would be consistent with the *Forest Plan* snag standard (*HFP,* p. II/21) because the average snags per acre in both of the local third order drainages far exceeds the minimum 2 per acre specified in the *Plan*. The potential for firewood cutting and snag removal during flume maintenance to measurably impact average snag numbers is low, given the abundance of dead lodgepole pine trees currently present. Over the next several years, however, snags will be lost through natural attrition until eventually very few snags larger than 7 inches dbh will remain [*Forested Vegetation Report,* p. 36]. For several years the average snags per acre in the 2 local drainages is likely to be much closer to the *Forest Plan* threshold for compliance.

The proposal would also be consistent with the standard. Even with the removal of most dead trees on 490 acres, the average snags per acre in each third-order drainage would still far exceed the minimum specified in the *Plan*. The estimated snags remaining after treatment would be 25/acre in the Buffalo C reek drainage and 38/acre in the Tenmile Creek drainage.

Elk: Hunting Season Security

Elk management during the hunting season focuses on maintaining population numbers above viability thresholds, protecting certain sex and age classes from over-harvest, providing public hunting opportunity, and attempting to balance elk distribution across public and private lands.

Elk security has been defined as "the protection inherent in any situation that allows elk to remain in a defined area despite an increase in stress or disturbance associated with the hunting season or other human activities" (Lyon and Christensen 1992). This analysis focuses on hunting season security, when the primary issue is more one of hunter access and less one of displacement of elk from preferred habitat (which is a key issue on summer range). Elk *vulnerability* as used here is the reverse of security.

Hiding Cover / Open Road Density Index

The current *Helena Forest Plan* standard for measuring elk security/vulnerability during the hunting season [big game standard 4a (*HFP,* p. II/17 – II/18)] uses an index that combines open road density and

hiding cover. For details of these calculations, refer to the Wildlife Background Report under the Elk: Hunting Season Security section. Forest roads are calculated at 100% of their length, private roads at 25%. Hiding cover is derived from "crown closure" (using the MDFWP definition) via a *Forest Plan* formula (*HFP,* top of page II/18). Cover needs to occur in stands at least 40 acres in size to qualify as "Forest Plan hiding cover".

Elk Security Areas

An alternative way of assessing elk security/vulnerability is to evaluate the size and distribution of *elk security areas* within a given herd unit or group of herd units. The basic methodology was developed by Hillis and others (1991) and has been in general use in the northern Rockies for over 20 years. Hillis et al. defined an elk security area as a block of predominantly forested habitat at least 250 acres in size with all boundaries ½ mile from an open road. The HNF has modified this approach for more open east-side Forest habitats: in the Divide landscape, minimum security area size is now 400 acres and boundaries are sometimes set more than ½ mile from open roads (or motor trails) depending on the influence of a variety of environmental circumstances, such as the roughness of the terrain, the distribution and quality of hiding cover, the reach of internal closed road networks, ease of hunter access to the area, distance from population centers, the presence of natural barriers, etc. Under this system, the first objective is to maintain at least 30% of each elk herd unit as security areas.

Comparing Security/Vulnerability Measures

Current *Forest Plan* big game standard 4a attempts to quantify both hiding cover and open road density and then merge them into a single number that can indicate the viability of a particular area to protect bull elk during the hunting season. This is a reasonable approach since (1) it is intuitively obvious to hunters and wildlife biologists that ducking into hiding cover is an effective means for elk to avoid being detected and shot and (2) research continues to find that low open road density correlates well with areas that bull elk choose to inhabit during the hunting season [see the recent study by Proffitt et al. 2013]. The problem has not been with the reality of hiding cover and open roads as key factors in elk security but rather with the numerical formulas that have been used to integrate them, the sensitivity of these formulas to what is going on in the elk population, and the thresholds used to trigger red flags for management.

While the relationship between open road density and hiding cover can be informative, it does not account for the spatial arrangement and size of unroaded patches, topography as a mediator of hunter access, the distribution of forage, and other factors that influence the ability of elk to survive the hunting season. Forest stands that do not meet the definition of hiding cover may prove to be secure areas for elk where local conditions of topography, remoteness, and environmental barriers impede hunter access. Conversely, blocks of hiding cover situated in roaded country may be highly insecure. Hiding cover has a role to play but it is not synonymous with security (Lyon and Canfield 1991; Unsworth and Kuck 1991; Lyon and Christensen 1992; Christensen *et al.* 1993).

The security area approach, while recognizing the role of hiding cover as a key component of elk security does not attempt to quantify it precisely. Instead, it emphasizes the size and distribution of unroaded areas large enough to dilute hunting pressure and allow elk enough varied habitat in which to elude

hunters and carry on with daily life. The HNF recognizes hiding cover as one of several key habitat features that factor into delineating security area boundaries—pulling boundaries further away from roads where cover is deficient. But it is no longer the controlling factor.

In the end, the security area approach is focused more on the distribution pattern of open roads/motor trails and hiding cover within a given elk herd unit, while the hiding cover/open road density approach is based on the combined magnitude of these two components within a herd unit, without regard to pattern. The test of which approach is the more useful is tied to how accurately they predict the status of local elk populations with regard to *Montana Elk Plan* objectives—in particular, bull/cow ratios and overall population numbers.

No-Action

No-action would allow natural processes to go forward along the Red Mountain Flume and around Chessman Reservoir and its adjoining meadows. The existing cover conditions would be retained in those areas and future cover conditions would develop without substantial human intervention (aside from minor local changes generated by ongoing maintenance along the flume).

In the early 1980's, the total elk population on the Helena National Forest was estimated at about 5,000 (4,900 elk in 1981) (*HFP,* p. V/5). The *Helena Forest Plan* (released in 1986) sought to improve this number by devising big game standards designed to provide enough habitat on the National Forest to support 6,400 elk by 2000. This was in support of MFWP goals for harvestable elk (*HFP,* p. V/5). Currently, MFWP aerial survey data indicate that at least 13,075 elk inhabit hunting districts that overlap the Helena National Forest.

The No-Action alternative would take no action that would directly impact these elk population numbers in the short-term. Over the long-term, loss of hiding cover via the downfall of dead trees throughout the project area and the Plan Area holds real potential to influence elk population numbers and distribution on a large scale.

Elk populations in the Flume Chessman Project Area and in the 3 elk herd units are situated within MFWP *Hunting District 335.* This district lies east of the Continental Divide and south of U.S. Highway 12. It encompasses the Quartz EHU, the eastern half of the Jericho EHU, and most of the Black Mountain–Brooklyn Bridge EHU, which together, make up the western 60% of the hunting district. The eastern 40% of the district covers BLM and private land in the adjacent foothills and Prickly Pear Valley south of Helena.

MFWP winter range surveys showed the elk population increasing in the decade 1999-2008: Population counts that averaged 510 elk earlier in the decade had risen into the 665-775 range by 2006-2008 (see *Table 5* below]. MFWP biologists felt that this was a function of mild winters, increased travel restrictions in the Clancy-Unionville area of the HNF, and fewer hunting permits for antlerless elk (*MFWP HD 335 Elk Survey 2005,* 2007). In 2009 the number of elk counted dropped to 450, and then to 388 in 2010. As in some other local districts, MFWP believes that the lower counts were the result of a less effective survey method and of elk having moved off winter range by the time surveys were conducted [see *Post-season Survey of Elk in HD 335* for 2010 and 2011]. There was no evidence of a

sudden increase in hunter success, elevated natural mortality, or decreased calf production/survival that might initiate a downward trend in local elk numbers. By 2011, the elk count was back up to where it had been prior to 2009: 670 elk were tallied in 2011 and 998 elk in 2012—both numbers exceeding the HD 335 objective of 600 elk (±20%) [MFWP *2011, 2012 Post-season Surveys of Elk in HD 335*].

Table 25: Observed during MFWP aerial surveys of winter range in HD 335 since 2000. Total numbers and bull/cow ratios are relevant to fall security. Calf/cow ratios are more a reflection of summer range quality.

Year	Total Elk	Bulls/100 Cows	Calves/100 Cows
2000	614	18	38
2001	513	11	56
2002	529	13	18
2003	569	12	32
2004	418	12	42
2005	555	13	35
2006	771	10	27
2007	776	13	35
2008	667	12	15
2009	450	-	-
2010	388	13	32
2011	670	19	45
2012	998	13	28
2013	827	9	23
Late Winter Count Objectives	600 ±20% (480–720)	≥10 bulls/100 cows	≥30 calves/100 cows

Bull/cow ratios have been fairly consistent since 2000, averaging 13 bulls/100 cows. The 2011 count was the highest in the last 25 years at 19 bulls/100 cows. The objective for the hunting district is a minimum of 10 bulls/100 cows. Brow-tined bulls, however, have accounted for only about 2% of the count during this period (almost certainly an underestimate, but lower than biologists would like) [see MFWP 2000-2007, 2008-2012].

The upshot is that the primary MFWP population parameters likely to be impacted by elk security habitat on the HNF (namely, total population numbers and bull/cow ratios) have exceeded *Montana Elk Plan* objectives each year for the past several years. Bull/cow ratios have consistently been close to or above the threshold of 10 bulls/100 cows since 2000 and, with the exception of years in which there were problems with aerial survey methodology and timing, total elk numbers have been well above MFWP objectives since 2006. Alternative 1 would make no changes that would influence this.

Effects on Forest Plan Big Game Standard 4a

The No-Action would have no effect on open road density and would have no immediate effect on hiding cover in any of the 3 local elk herd units. As a result, the hunting season hiding cover/open road density indices for these units would remain unchanged: the Quartz and Black Mountain-Brooklyn Bridge EHUs would continue at their current level of non-compliance with the standard and the Jericho

EHU would continue to comply (as can be seen by plotting the open road density and percent hiding cover figures in *Table 6* on the graph in *Figure* 13).

Table 26: Current hiding cover and open road density on fall (hunting season) elk range. These conditions are equivalent to outcomes under No-Action for the next 2 or 3 years. After that, hiding cover will decrease as dead trees fall, so that eventually all 3 herd units will be out of compliance with big game standard 4a.

Elk Herd Units →	Quartz	Black Mtn – Brooklyn Bridge	Jericho
total square miles of fall range in the EHU	57	88	55
open road density (mi/mi²) during the hunting season	1.1	1.9 *	1.2
current acres of *Forest Plan* hiding cover on fall range	16,477	29,260	23,091
current percent *Forest Plan* hiding cover on fall range	45%	52%	65%
change in hiding cover under Alternative 1	0	0	0
change in open road density under Alternative 1	0	0	0
Does the result comply with standard 4a?	**no**	**no**	**yes**

* Open road density in this herd unit is highly overestimated by this calculation—as a result of the 1.5 mile off-Forest EHU extension reaching well into the City of Helena. The intent of the extension was to include off-Forest areas of winter range actually occupied by elk and to exclude areas that were unsuitable. Nonetheless, the GIS delineation used here included downtown Helena, thus dramatically expanding open road density. The delineation will be corrected in future analyses.

Effects on Elk Security Areas

The 3 elk herd units that overlap the Flume Chessman treatment units encompass 9 elk security areas in the southeast quadrant of the Divide landscape. Average security area size is 3,840 acres. The current status of elk security areas and the impact of Alternative 1 are displayed in *Table 7.*

Table 27: Elk Security Area Data in 3 Elk Herd Units.

Elk Herd Units	Quartz	Black Mtn – Brooklyn Bridge	Jericho
acres of fall range in the EHU	36,733	56,339	35,345
current acres in elk security areas	7,045	14,069	8,756
percent of the elk herd units in security areas	31%	39%	30%
Do the EHUs comply with 30% guidelines?	yes	yes	yes
Changes in security acreage under Alternative 1	0	0	0
herd units in security areas	31%	39%	30 %
Does the result still comply with the guidelines?	yes	yes	yes

No-Action would produce no new open roads—the main determinants of security area boundaries—and thus would have no immediate effect on the configuration or effectiveness of any elk security area. Two herd units would continue to see more than 30% of their area occupied by elk security areas. In the 3rd herd unit (Jericho EHU) security areas would continue to occupy just about 30% of the unit.

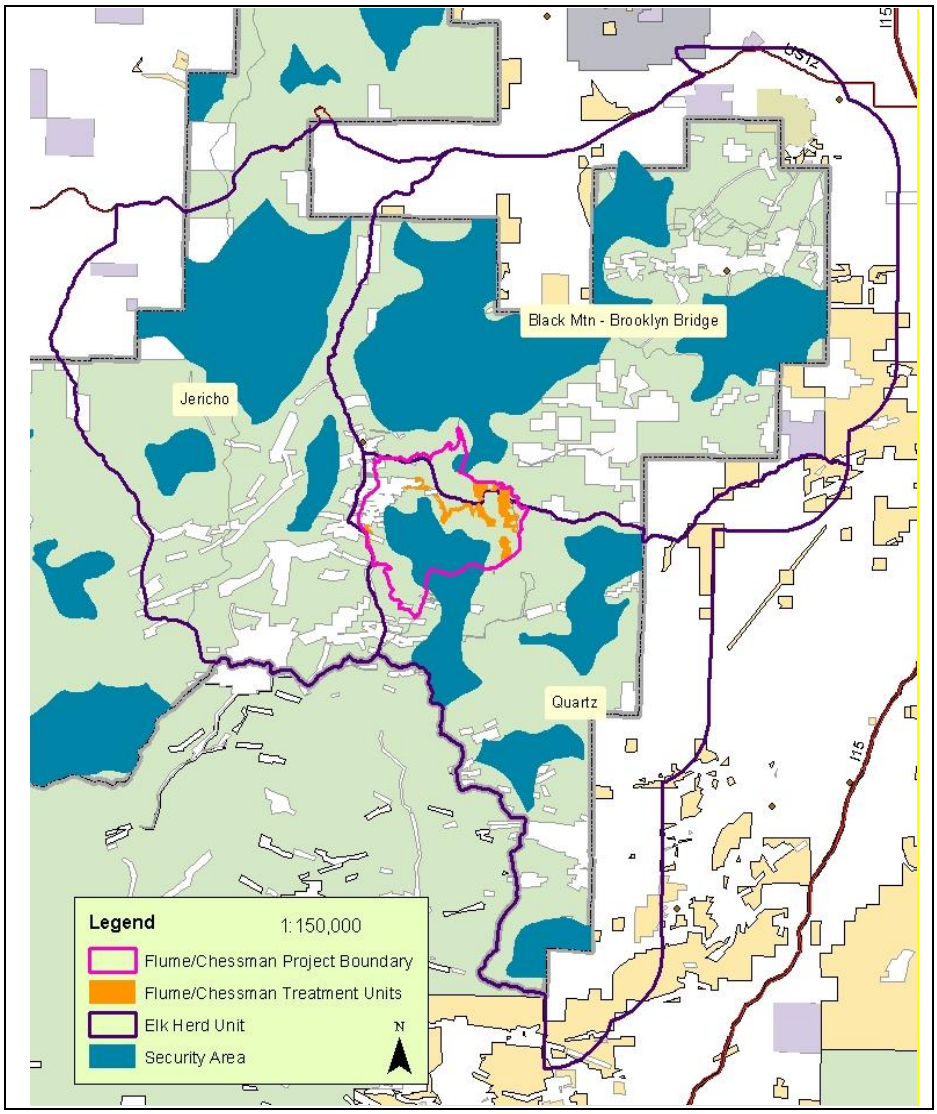


Figure 18: Elk security areas in the Quartz, Jericho, and Black Mountain-Brooklyn Bridge elk herd units. It can be seen that while the project area overlaps parts of 2 security areas to the north and south, treatment units would not.

As seen in the above *Figure,* the Project Area overlaps the northern half of a security area around Red Mountain to the south and it clips the southern tip of another security area centered on the Lazyman Roadless Area just to the north. But with no-action, no new vegetation manipulation would occur in the project area, and shifts in hiding cover would be a function entirely of natural processes.

As dead trees fall over the next decade and hiding cover throughout much of the project area and these 2 security areas disappears, it is likely that security area boundaries will need to be redrawn to account for changing circumstances. While, in the future, accumulated deadfall will make it difficult for hunters to move through these areas, sight distances will be much longer.

Proposal

The proposal would treat approximately 490 acres—removing all dead trees and woody debris from a corridor averaging 450 ft wide along the flume (150 ft upslope and 300 ft downslope from the flume) and removing most dead trees and woody debris from a broad swath around Chessman Reservoir and its meadows. All hiding cover within the units—currently 434 acres—would be lost. Approximately 0.5 mile of low-grade road would be constructed east of Chessman Reservoir: It would not be open to public vehicle use and it would be obliterated after the project.

Effects on Elk Populations in HD 335

Elk population parameters that likely to be affected by changes in elk security on the National Forest (total population numbers; bull/cow ratios) are not expected to be affected in any measurable way by Alternative 2. Elk populations in this district have been exceeding MFWP population objectives for the past few years in spite of extensive cover loss both on and off the Forest. Observed numbers are likely to change in the future—as they do every year—but these shifts will be due to the vagaries of the survey process, weather-driven changes in hunter success, area-wide cover loss from the bark beetle outbreak, shifts in elk distribution with regard to winter range, and so on.

Effects on Forest Plan Big Game Standard 4a

Under Alternative 2, open road densities during the hunting season would remain constant. The short segment of temporary access road constructed west of Chessman Reservoir would not be open to motorized use by hunters. It would receive a minimal amount of "administrative use" by HNF personnel during the hunting season, which would temporarily displace any elk or deer in the vicinity of the road, but it would not put them more at risk from being shot. Unlike "habitat effectiveness" which measures the extent to which open roads displace elk from otherwise suitable habitat on summer range, the open road density component of standard 4a is designed to measure the potential for hunters to probe into fall elk habitat and kill elk. If this half mile of closed road were added to the open road mileage for the Quartz EHU, open road density in that herd unit would increase from 1.07 mi/mi² to 1.08 mi/mi². The impact on elk vulnerability would be essentially non-existent.

The proposal would remove an estimated 434 acres of hiding cover from treatment units. As a result, hiding cover would decline by 0.9% in the Quartz EHU and by 0.1% in the Black Mountain–Brooklyn Bridge EHU: these 2 herd units would remain out of compliance with *Forest Plan* big game standard 4a. With the removal of only 4 acres of hiding cover from the Jericho EHU, the percentage would remain essentially where it is now, and that unit it would remain in compliance with the standard.

Table 28: Hiding cover and open road density on fall elk range under Alternative 2: Compliance with *Forest Plan* big game standard 4a.

Elk Herd Units	Quartz	Black Mtn – Brooklyn Bridge	Jericho
total square miles on fall range in the EHU	57	88	55
current **open road density** (mi/mi²) on fall range	**1.1**	**1.9**	**1.2**
current acres of *Forest Plan* hiding cover on fall range	16,477	29,260	23,260
current *Forest Plan* **percent hiding cover** on fall range	**45%**	**52%**	**65 %**
Does the result comply with standard 4a?	no	no	yes
post-project **open road density** under Alternative 2	**1.1**	**1.9**	**1.2**
post-project hiding cover acres under Alternative 2	16,134	29,173	23,087
post-project **percent hiding cover** under Alternative 2	**44%**	**52%**	**65 %**
Does the result comply with standard 4a?	**no**	**no**	**yes**

The fact that two of the 3 elk herd units that occupy 60% of hunting district 335 are out of compliance with the *Forest Plan* big game standard for elk security while elk population numbers and bull/cow ratios have been consistently higher than what MFWP expects should be the norm suggests that something is awry with the standard. The standard indicates that HNF elk security is inadequate when, in fact, the elk populations that the standard is designed to protect are exceeding expectations. The proposal would reduce hiding cover slightly, but given the fact that the elk population has remained sound in spite of recent cover losses throughout the 3 herd units [see "*Cumulative Effects"*], it is unlikely that this loss would have any impact whatsoever.

Effects on Elk Security Areas

Treatment units in the proposal would not impinge upon any of the nearby elk security areas. The treatment units along the flume come close to the Red Mountain security area to the south, but they do not intrude. The north edge of that security area begins at the steep slopes of Red Mountain itself, and the flume units are confined to the more gradual slopes below—so the loss of hiding cover there would have no practical effect on the location of the security area boundary. The security area data presented for no-action alternative apply also to this proposal.

Cumulative Effects

The cumulative effects analysis area for gauging elk security is the Combination Area (136,105 acres), which is equivalent to the combined area of the 3 elk herd units (128,418 acres) plus a few peripheral areas added by lynx analysis units (LAUs).

The primary activities that have eroded elk security in the cumulative effects area over the past century have been (1) the removal of forested cover by timber harvest and fire (earlier in the 20th century) and (1) ubiquitous road construction.

The reach of the open road network in the Combination Area is approximated by the weighted open road density in the 3 combined herd units: 1.3 miles of open road per square mile—or 265 miles of open road within a 201 mi² area. [Road miles are "weighted" so as to indicate their relative impact to elk during the hunting season. Forest roads open to public hunting are calculated at 100% of length; private

roads with limited access are calculated at 25% of length]. These roads have increased open road density to the detriment of *Forest Plan* standard 4a. The expansion of the open road system has reduced the size of elk security areas as well. Few permanent open roads have been constructed on Forest lands in the past 25 years. Most new roads have been short access routes to private inholdings. In a number of other cases, previously closed roads have been temporarily opened to allow access for log hauling, mineral exploration, and other activities that have locally complicated elk security patterns for a period.

Forest Service timber harvest and fuels treatments have been active over several decades in the Combination Area, creating a widespread pattern of early-seral and mid-seral habitats amidst the mature forest. Some cutting/burning units have been large enough—before they've developed screening saplings—that elk and deer only use them as foraging areas only near the edges. Others are small enough to contribute to the kind of cover/forage mosaics that allow animals to feed in close proximity to cover in several directions.

The table below summarizes timber harvest and fuels treatment activity on HNF land in the Combination Area since 1960. Timber harvest has occurred on 3.6% of the area since then—a little over 90% of it in the form of regeneration harvest (mostly clearcutting and seedtree cutting). Since 1990, fuels treatment has become the predominant vegetation manipulation activity. Since 1960 it has affected 7.5% of the area. Fuels treatments are designed primarily to reduce fuel concentrations rather than to yield commercial timber. As a result, they are most often maintained in open-grown forest condition rather than being allowed to regenerate to hiding cover as are the timber harvest units.

Table 29: Timber harvest and fuels treatment activity on HNF land in the Combination Area (136,105 acres) since 1960 and the evolution of treated areas toward hiding cover.

Decade	Timber Harvest acres	Fuels Treatment acres	Expected vegetation structure in most timber harvest units today *	Current hiding cover in most harvest units
1960 – 1969	26	17	young mature / pole-sized conifers	effective hiding cover
1970 – 1979	1,602	940	pole-sized conifers	effective hiding cover
1980 – 1989	1,195	866	mid to large-sized sapling conifers	effective hiding cover
1990 – 1999	477	1,551	small to mid-sized sapling conifers	patchy hiding cover
2000 – 2009	749	3,541	seedling conifers / grasses & forbs	no hiding cover
2010 – 2013	888	3,242	developing grass & forb cover	no hiding cover
Total	4937	10,157		

* The most common structure in recent fuels treatment units is "open forest"—and they are generally maintained in an open-grown condition. So, hiding cover is not expected to develop in most of these stands..

Timber harvest and salvage operations have also occurred on numerous private inholdings in the Combination Area, many of them salvage operations in the last decade—and these areas currently lack hiding cover. This includes the approximately 160-acre fuel break along the lower Red Mountain Flume that the city of Helena has been working on for the past 2 years. Alternative 1 would make no immediate contribution to the sum of sites lacking hiding cover in the Combo Area; Alternative 2 would

add 490 acres. Within 5-10 years, natural decline of standing dead trees will add several thousand acres more—a circumstance that will produce the same result under both Alternatives 1 and 2.

The most influential natural events reducing forest cover in recent years are the MacDonald Pass fire (2009) and the mountain pine beetle outbreak (beginning around 2006). The pine beetle outbreak has not yet noticeably diluted hiding cover in most areas because tree trunks that provide much of the cover in mature stands are still upright. But this is about to change over the next decade, although its impact on elk security is unpredictable at this point.

Ongoing activities with some potential to disrupt elk security include (1) the Clancy-Unionville Vegetation Project and (2) the HNF roadside hazardous tree removal project, both of which are removing primarily dead trees and subtracting hiding cover immediately rather than allowing it to disappear slowly over a 5-10 year period.

Two reasonably foreseeable actions with implications for elk security are planned in the Combination Area: (1) the Divide Travel Plan, which proposes a variety of changes to current vehicle routes and may substantially change the size of several elk security areas, as well as reducing open road density and (2) the Telegraph Vegetation Project, ,which would remove dead trees and thin young conifer stands on >6,000 acres just west of the Continental Divide, eliminating hiding cover sooner rather than later.

Human activities with the greatest cumulative impact on elk habitat security in the Combination Area have been timber harvest/fuels treatments and construction of roads and motor trails. Timber harvest and fuels treatments on public land in that area have opened up over 15,000 acres of forested habitat since 1960. Roughly 65% of the harvested area has now regained hiding/screening cover, while a majority of the fuels treatment sites remain relatively open-grown. While a good deal of the current road system was already in place by 1960, much of it has been improved since then and more roads added by timber projects—all of which has aided motorized hunter access and lowered elk security. Over the last 25 years the number of open roads on HNF land in the Combination Area has declined via road closures often designed to improve elk security. The result can be seen in terms of security area distribution [*Figure 14*].

Retention of current conditions and trends around Chessman Reservoir and the Red Mountain Flume under Alternative 1 would not add significantly to cumulative effects generated by past, ongoing, or reasonably foreseeable human activity in the short term; nor would it change the outcome expected in the aftermath of the mountain pine beetle outbreak.

The removal of 434 acres of hiding cover from a compact region around the Red Mountain Flume and Chessman Reservoir under the “proposed action” would not add to past, on-going, and reasonably foreseeable cumulative effects in a way that would significantly impact the security of elk populations on the Forest as a whole or in hunting district 335. After another 5-10 years, the hiding cover regime produced by either the “proposed action” or by leaving natural forces to operate unfettered would be the same.

Forest Plan Consistency

The following standards and guidelines apply to elk security during the hunting season. Those standards that do not apply are not listed here.

Big Game Standard 4a: Hunting Season Security

Big game standard 4(a) (*HFP,* p. II/17-18) requires that an aggressive road management program be implemented to maintain or improve big game security (habitat capability and hunting opportunity). Under *Alternative 1*, two herd units would fail to meet the dictates of standard 4a's hiding cover/open road density index; and although the alternative would neither increase open roads nor actively reduce hiding cover, it would remain out of compliance with the standard. The proposal would further reduce hiding cover in the 2 non-compliant herd units and would thus fail to comply with the standard. Therefore a site-specific *Forest Plan* amendment would be needed to exempt the project from this standard. However, because this alternative is not expected to negatively impact elk populations in HD 335—protecting the elk population being the ultimate goal of the standard—the site-specific exemption would not compromise the ability of the Forest to realize *Forest Plan* goals and objectives; nor would it compromise MFWP's ability to achieve population objectives of the *Montana Elk Management Plan* (2004).

Big Game Standard 6: Montana Elk-Logging Study Recommendations

Big game standard 6 (*Forest Plan* II/19 and C/1 -11) requires that the recommendations of the *Montana Cooperative Elk-Logging Study* (*Forest Plan* Appendix C*)* be followed during timber sale and road construction projects. Of the 11 recommendations, eight relate to elk security to one degree or another. The *Elk-Logging Study* defines "security" rather broadly as "freedom from disturbance"(Lyon et al. 1985, p. 42); so, some of these recommendations are peripheral to hunting season security as used in this report [see Lyon and Christensen 1992]. The recommendations do not apply to the no-action, which proposes no "logging" or road construction. Those actions proposed under this proposal would line up with the recommendations. See the Wildlife Background Report for results (Constain 2013).

Under both alternatives, two of the 3 elk herd units that converge at the project area (the Quartz and Black Mountain–Brooklyn Bridge EHUs) would fail to comply with *Forest Plan* big game standard 4a (the hiding cover/open road density index). Under both alternatives, the third herd unit (the Jericho EHU) would continue to comply with standard 4a. Neither alternative would fail to comply with any other *Forest Plan* standard or guideline related to elk security. Neither alternative would intrude upon local elk security areas and elk security area coverage would remain at acceptable levels in all 3 herd units. Neither alternative would measurably impact elk population size structure or distribution in in the surrounding hunting district (HD 335).

Under both alternatives, hiding cover provided by standing trees (now predominantly dead) in the project area would be mostly gone 5-10 years from now, changing the local security environment for elk. Loss of hiding cover throughout the area will make it impossible for any of the 3 elk herd units that make up the bulk of the area to meet big game standard 4a.

Elk Hunting Season Security Conclusions for Alternative 1

The no-action would generate no immediate changes that would impact elk security in the project area or in the 3 surrounding herd units. Loss of hiding cover over the course of the next 5-10 years would result from the mountain pine beetle outbreak and would not be a consequence of no-action.

Elk Hunting Season Security Conclusions for Alternative 2

The proposal would subtract 434 acres of hiding cover from a relatively compact area around Chessman Reservoir and the Red Mountain Flume. This would put the 2 local elk herd units that currently do not comply with *Forest Plan* big game standard 4a further out of compliance. This would require an *exemption* from the standard in order for the project to go forward. The exemption is justified because the proposal would have no more impact on the security, size, and structure of elk populations in hunting district 335 than the no-action. In addition, within 5-10 years there would be no difference in hiding cover between Alternatives 1 and 2.

Elk: Summer Range and Calving Areas

From late spring through late summer, elk need secluded calving areas and summer range rich in nutritional forage. Key habitat components for elk on summer range include a mix of hiding cover, summer thermal cover [*not* the winter thermal cover addressed by *HFP* big game standard 3], open foraging areas (generally small enough so that no point is more than 600 ft from a forest edge), forested forage, and riparian sites (including some open water) (Thomas et al. 1979, p. 109-121). The same habitat characteristics are important for calving, but in addition, a good distribution of low-level cover, such as logs, deciduous shrubs, and conifer regeneration is important for concealing calves. In addition, water sources are particularly important for lactating cows (Thomas et al. 1979, p. 120). Research suggests that the quality of summer range—via its ability to contribute to late summer nutrition—may be the most important variable in determining annual variation of herd growth (Stewart et al. 2005; Cook 2002, p. 305; Cook et al. 1996).

Local summer range habitat components of concern are identified by the *Montana Cooperative Elk-Logging Study* (Lyon et al. 1985, p. 12-13). Recommendations from the study have been incorporated into the *Forest Plan* as big game standard 6 (and are included in the *Plan* as *Appendix C*). Components present in the project area include calving areas and sites for concealing calves, the local cover/forage matrix, wet sites, and summer thermal cover. These habitat elements can be surveyed and evaluated on a local basis—as within a project or treatment area—but they are difficult to assess in any detail over broader areas, such as elk herd units. In the case of the Flume Chessman Project Area, these features have been examined via field surveys of proposed treatment units (proposal) and other parts of the project area and their value assessed qualitatively site by site.

No-Action

No-action would allow natural processes to play out along the Red Mountain Flume and around Chessman Reservoir and its adjoining meadows. The existing conditions of cover and calving sites would be retained in those areas, and future conditions would develop without substantial human intervention (aside from minor changes generated by ongoing maintenance of the flume).

Elk Populations in Hunting District 335

MFWP surveys have shown the elk population increasing modestly, if somewhat erratically, since the 1990s. The average population of 776 animals in all age classes over this time period is above the 600 elk that MFWP has set as the expected norm for the hunting district.

Calf/cow ratios have been more variable over the last 10 years, ranging from 15 calves/100 cows (2008) to 45 calves/100 cows (2011). The 2012 count was 28 calves/100 cows. The 10-year average is 34 calves/100 cows—which is typical of hunting districts in this part of Montana and indicates a level of calf production and survival sufficient to maintain current elk populations under a normal regime of hunting and natural predation. The 2012 ratio was 28 calves/100 cows, which MFWP characterized as a "moderate" figure.

In any event, these two population parameters, which reflect, at least partially, the quality of summer ranges available to elk, are within the range that MFWP would like to see.

Local Habitat in the Project Area

Elk cows and yearlings move up into the area around Chessman Reservoir anywhere from mid May to early June, depending on snow and green-up conditions. This time period coincides with elk calving, so that in some years, this broad ridge between the Tenmile Creek and the Lump Gulch-Quartz Creek drainages serves as a calving area. Bulls generally push up into the area earlier in the season, following the snowline. Substantial numbers of elk remain here throughout the summer and as far into the fall as snow and forage conditions allow—although fall distribution is typically modified by hunting pressure and the need to find secure havens.

In the past, the closed-canopied lodgepole pine forests that have dominated much of the Chessman area for several decades provided effective summer thermal relief and also, decent hiding cover. Now that a large majority of the forest habitat around the reservoir is dominated by standing dead trees, the summer thermal function of these stands has mostly disappeared. The tree trunks still provide hiding cover but over the next decade this component will fade away as well with the downfall of the snags. Opportunities to conceal calves and to locate screened bedding sites, on the other hand will increase dramatically. None of this affects the distribution of water across the area, although the absence of mature tree cover should allow local water levels to rise in some areas: so this resource will remain relatively constant for lactating cows and for reliable forage production. Under the no-action, these conditions will unfold in this manner across the entire project area.

Figure 19: Hiding cover on fall/summer elk range unit #14. Most overstory foliage is gone from these mature/pole-sized lodgepole pine trees, but the stand still provides hiding cover via trunk density. Once all snags were down, there would be some cover for bedded animals and for concealed fawns and calves provided by the tall bluejoint grass and a little regeneration—but no standard hiding cover. *photo: B.Costain.*

Effects on Forest Plan Big Game Standard 3

Current acreages and percentages of *Forest Plan* hiding cover on summer range in the 3 local elk herd units are shown in the next table. Hiding cover is estimated from percent canopy cover; and so, the threshold for compliance with the hiding cover requirement in big game standard 3 is ≥50%.

Table 30: Compliance of the No-action with *Forest Plan* Standard 3. Hiding Cover on Elk Summer Range.

Elk Herd Units	Quartz	Black Mtn – Brooklyn Bridge	Jericho
acres of summer range in the EHU	36,734	56,339	35,345
current acres of *Forest Plan* hiding cover	16,477	29,260	23,091
acres of *Forest Plan* hiding cover to be treated	0	0	0
acres of *Forest Plan* hiding cover remaining	16,477	29,260	23,091
percent *Forest Plan* hiding cover remaining	45%	52%	65%
Does the result comply with standard 3?	no	yes	yes

The Jericho and Black Mountain–Brooklyn Bridge EHUs both comply with the standard; the Quartz EHUs does not. In spite of this lack of unanimity in compliance, hunting district 335 has had no problem maintaining elk population numbers and calf/cow ratios over the past several years.

These levels of hiding cover on summer range would continue under the no-action for probably another 5 years, after which enough dead trees will have fallen to begin the erosion of cover throughout much of the 3 herd units. After 5-10 years, when hiding cover has declined dramatically below levels required by

standard 3, the evolution of elk population size and structure in HD 335 will be revealing as to the role of hiding cover in providing quality summer range.

Effects on Habitat Effectiveness

Habitat effectiveness, as estimated from herd unit-wide open road density, is at or above 50% in all 3 herd units. Road density calculated in this way—for the whole herd unit—is substantially higher than they would be if calculated only for true summer range. For a variety of reasons, neither the HNF nor MFWP has been able to successfully delineate summer range boundaries (which are amorphous and shift from year to year). As a result, heavily roaded lower elevation areas (often with a lot of private land) that elk do *not* use as summer range are included as summer range. Still, habitat effectiveness emerges as viable in all 3 herd units. Based on a rough estimate of the extent of actual summer range, habitat effectiveness looks to be more on the order of 60-80% for these herd units. Again, low habitat effectiveness serves as a general indicator as to whether elk summer range needs to be examined in more detail and on a site-specific basis for potential problems. In this case, summer range appears to be in good condition.

Table 31: Habitat effectiveness under the No-action—calculated for entire herd units (as opposed to being calculated just for summer range).

Elk Herd Units	Quartz	Black Mtn – Brooklyn Bridge	Jericho
summer range open road density (mi/mi²)	1.1	1.9	1.2
summer range habitat effectiveness	5%	50%	57%
Is the ≥ 50% habitat effectiveness guideline met?	yes	yes	yes

These results are more in line with the population data that MFWP has compiled for hunting district 335 over the past 3 years—indicating that enough summer elk habitat is available for the elk population to continue meeting MFWP population objectives. Under the No-Action, habitat effectiveness would continue at this level.

Proposal

The proposal would treat approximately 490 acres—(1) removing all dead trees and woody debris from a 300 ft. wide corridor on either side of the Red Mountain Flume and leaving open habitat with scattered trees; (2) removing all dead trees and the bulk of the woody debris from a broad swath around Chessman Reservoir and its meadows, leaving open grown forest of widely varying density. The alternative would also construct approximately 0.5 mile of temporary road on the east side of Chessman Reservoir. The road would not be open to public vehicles and would be obliterated post-project.

Effects on Forest Plan Big Game Standard 3

Under the proposal, *Forest Plan* hiding cover would drop from 44.9% to 43.9 %—further out of compliance with the 50% standard. The Jericho and Black Mountain–Brooklyn Bridge EHUs would decline slightly, but would remain above the 50% threshold and in compliance with the standard. As with Alternative 1, the failure of the Quartz EHU to comply with the summer hiding cover standard is not reflected in the key elk population parameters for HD 335, which have been in line with MFWP

objectives for the past several years. However, because the standard is not met, a site-specific amendment or an exception to the *Forest Plan* with regard to big game standard 3 will be needed.

Table 32: Compliance of the Proposal with *Forest Plan* Standard 3. Hiding Cover on Elk Summer Range.

Elk Herd Units	Quartz	Black Mtn – Brooklyn Bridge	Jericho
acres of summer range in the EHU	36,734	56,339	35,345
current acres of *Forest Plan* hiding cover	16,477	29,260	23,091
acres of *Forest Plan* hiding cover treated	343	87	4
acres of *Forest Plan* hiding cover remaining	16,134	29,173	23,087
percent *Forest Plan* hiding cover remaining	44%	52%	65%
Does the result comply with standard 3?	no	yes	yes

Effects on Habitat Effectiveness

The proposal would construct about ½ mile of road, which would be closed to the public and would be obliterated at project's end. Therefore, it would have no influence on habitat effectiveness as computed by Lyon (1983) and Leege (1984). Even if it were included in the calculation, it is too small a road segment to move the habitat effectiveness percentages. As discussed for the no-action, these road densities (for entire herd units) are substantially higher than they would be for summer range alone. This is not an issue. Elk population parameters affected by summer range conditions have been in line with MFWP expectations over the past 10 years.

Table 33: Habitat effectiveness on elk summer range under Alternative 2.

Elk Herd Units	Quartz	Black Mtn – Brooklyn Bridge	Jericho
summer range open road density (mi/mi²)	1.1	1.9	1.2
summer range habitat effectiveness	59%	50%	57%
project generated change in open road density	0	0	0
post-project summer range habitat effectiveness	57%	50%	59 %
Is the >50% habitat effectiveness guideline met?	yes	yes	yes

Cumulative Effects

The cumulative effects analysis area for examining hiding cover and habitat effectiveness on summer range is the Combination Area (136,105 acres), which is equivalent to the combined area of the 3 elk herd units (128,418 acres) plus a few peripheral areas added by lynx analysis units (LAUs). The area for assessing local riparian and moist sites is the Project Area.

As with elk security, the primary activities that have reduced the suitable summer range available to elk in the cumulative effects area over the past century have been (1) the removal of forested cover by timber harvest and fire (earlier in the 20th century) and (1) widespread road and motor trail construction.

Open roads are the key to determining elk habitat effectiveness. The extent of the open road network in the Combination Area is approximated by the open road density in the 3 combined herd units: 1.46 miles of open road per square mile—or 294 miles of open road within a 201 mi² area. If the entire herd

unit were equated to “summer range”, this would equate to an overall habitat effectiveness of about 54%, which is a bit above the recommended 50% threshold. Actual habitat effectiveness for summer range typically used by elk is probably more on the order of 65%-75%. Nonetheless, roads on elk summer range have subtracted suitable elk habitat from the base that would otherwise be available to elk, lowering habitat effectiveness. Few permanent open roads have been constructed on Forest lands in the past 25 years. Most new roads have been short access routes to private inholdings. In a number of other cases, previously closed roads have been temporarily opened to allow access for log hauling, mineral exploration, and other activities that have displaced elk from areas they would otherwise have been using during that period.

Forest Service timber harvest and fuels treatments have created a widespread pattern of early-seral, mid-seral, and later-seral forest habitat in the Combination Area. Early-seral openings are the preferred foraging areas for elk and continue on as such into the mid-sized sapling stage, although forage volume decreases as trees being to crowd out ground vegetation. Some cutting/burning units have been large enough—before they’ve developed screening saplings—that elk and deer only use them as foraging areas only near the edges. Others are small enough to contribute to the kind of cover/forage mosaics that allow animals to feed in close proximity to cover in several directions.

Timber harvest has occurred on 3.6% of the area since 1960 (most of it by clearcutting and seedtree cutting). Fuels treatment has affected 7.5% of the area, and since 1990, has become the predominant vegetation manipulation activity. [There is some overlap in acreage between timber harvest and fuels treatment, as some fuels work follows timber harvest in the same units]. Units treated for fuel reduction are most often maintained in open-grown forest condition rather than being allowed to regenerate to hiding cover as are the timber harvest units. Forested forage in the open stands is inevitably better than in the closed stands, but the open stands generally provide little hiding cover.

Table 34: Timber harvest and fuels treatment activity on HNF land in the Combination Area (136,105 acres) since 1960 and the evolution of treated areas with regard to hiding cover and forage.

Decade	Timber Harvest acres	Expected vegetation structure in most timber harvest units today	Current hiding cover in most harvest units	Fuels Treatment Acres *
1960 – 1969	26	young mature / pole-sized conifers	effective hiding cover / patchy forage	17
1970 – 1979	1,602	pole-sized conifers	effective hiding cover / little forage	940
1980 – 1989	1,195	mid to large-sized sapling conifers	effective hiding cover/ diminishing forage	866
1990 – 1999	477	small to mid-sized sapling conifers	patchy hiding cover / forage complex	1,551
2000 – 2009	749	seedling conifers / grasses & forbs	no hiding cover / effective forage	3,541
2010 – 2013	888	developing grass & forb cover	no hiding cover / developing forage	3,242
Total	**4937**			**10,157**

* The most common structure in recent fuels treatment units is “open forest”—and they are generally maintained in an open-grown condition. So, hiding cover is not expected to develop in most of these stands.

Timber harvest and salvage operations have also occurred on numerous private inholdings in the Combination Area, many of them salvage operations in the last decade—and these areas currently lack hiding cover. This includes the approximately 160-acre fuel break along the lower Red Mountain Flume that the city of Helena has been working on for the past 2 years.

The no-action would make no immediate contribution to the sum of sites lacking hiding cover or those providing forage in the Combo Area; the proposal would add 490 acres of new foraging habitat. Within 5-10 years, natural decline of standing dead trees will add several thousand acres more acres of non-hiding cover. In terms of hiding cover, the result will be essentially the same for result under both both alternatives. In terms of forage quality, Alternative 2 would be better in treatment units, since they would lack overtopping woody debris that would suppress ground vegetation development.

The most influential natural events reducing forest cover in recent years have been the MacDonald Pass fire (2009) and the mountain pine beetle outbreak (beginning around 2006). The pine beetle outbreak has not yet noticeably diluted hiding cover in most areas because tree trunks that provide much of the cover in mature stands are still upright. But this is about to change over the next decade as trees fall. In the meantime, with the suppressing effect of forest foliage having disappeared in these stands, ground vegetation and foraging opportunity is increasing.

Two reasonably foreseeable actions with implications for elk summer range and calving areas are planned in the Combination Area: (1) the Divide Travel Plan, which proposes a variety of changes to current vehicle routes and is likely to improve habitat effectiveness on some elk summer ranges, as well as closing some routes based on site-specific problems with key habitat components for elk and (2) the Telegraph Vegetation Project, ,which would remove dead trees and thin young conifer stands on >6,000 acres just west of the Continental Divide, eliminating hiding cover and opening up new foraging areas sooner rather than later.

Human activities with the greatest cumulative impact on elk summer range and calving areas have been timber harvest/fuels treatments and construction of roads and motor trails. Timber harvest and fuels treatments on HNF land in that area have opened up at least 10,000 acres of forested habitat since 1960. Roughly 65% of the harvested area has now regained hiding/screening cover but declined in forage value. A majority of the fuels treatment sites remain relatively open-grown with little hiding cover but relatively good foraging conditions. While a good deal of the current road system was already in place by 1960, much of it has been improved since then and more roads added by timber projects—much of which has aided motorized access to elk summer range and lowered habitat effectiveness. Over the last 25 years the number of open roads on HNF land in the Combination Area has declined via road closures often designed to improve elk security and habitat effectiveness.

Retention of current conditions and trends around Chessman Reservoir and the Red Mountain Flume under the no-action would not add significantly to cumulative effects generated by past, ongoing, or reasonably foreseeable human activity in the short term; nor would it change the outcome expected in the aftermath of the mountain pine beetle outbreak.

The proposal's removal of 434 acres of hiding cover from a compact region around the Red Mountain Flume and Chessman Reservoir would not add to past, on-going, and reasonably foreseeable cumulative effects in a way that would significantly impact summer range conditions for elk populations on the Forest as a whole or in hunting district 335. After another 5-10 years, the hiding cover regime produced by either the proposal or by leaving natural forces to operate unfettered would be the same. Hiding cover declines, foraging conditions improve.

Forest Plan Consistency

The following standards and guidelines apply to elk use of summer range. The standards that do not apply are not listed here.

***Big Game Standard 3*: Hiding Cover on Summer Range**

Big game standard 3 (*HFP,* p. II/17) requires that hiding cover on elk summer range be maintained at or above 35% (or, on in this case, 50% using the MFWP crown closure criterion). Hiding cover must be in blocks of at least 40 acres to be tallied as *Forest Plan* hiding cover. Under the no-action, one herd unit (Quartz EHU) would fail to meet the standard; but since the alternative would not directly remove any hiding cover, its maintenance of the status quo would be allowed to stand. The proposal would reduce cover in the 2 herd units that currently comply with the standard but not to the extent that they would fall out of compliance. It would also further reduce hiding cover in the herd unit that is below the 50% cover threshold and would thus fail to comply with the standard. Because this hiding cover will be lost by natural means in the next decade or so and because the proposal is not expected to negatively impact the elk population in HD 335, an exemption to the standard would be in order.

***Big Game Standard 4b*: Protection of Elk Calving Areas and Nursery Areas**

Standard 4b prohibits motorized use in identified elk calving grounds and nursery areas during peak use by elk (mid May through early July). While the project area has not been mapped by MFWP or the HNF as a calving ground/nursery area, it is likely that some calving occurs in this general area—around the meadows south of Chessman Reservoir and further south of there. Elk with calves probably remain in the general area during the nursing period. There are a number of roads in and around the project area that have been open to public vehicles for several decades without any problems for calf production and survival. The single temporary road planned for the project would not be open to public use. Project operations would not occur during the calving season. If nursery sites are discovered during the course of the project, operations would be modified to avoid the sensitive areas. The proposal would be in line with this recommendation. Refer to the Wildlife Background Report for discussion of these points (Costain 2013).

Canada Lynx

After 2 decades on the Northern Region sensitive species list, the Canada lynx was listed as a *threatened species* under the Endangered Species Act in 2000. The primary reason for listing was the absence of coherent management plans by resource agencies in the northern Rockies. Management direction is

now firmly established and a considerable amount of research is in the process of clarifying issues of lynx biology. In the meantime, the lynx remains listed.

In the northern Rockies, most lynx occurrence is associated with conifer forests dominated by lodgepole pine, subalpine fir, and Engelmann spruce in the 4900-6550 foot elevation zone. Secondary interspersed vegetation in the Divide landscape includes mid-high elevation Douglas-fir, whitebark pine, and aspen. Dry forest types, such as ponderosa pine and dry Douglas-fir seldom provide suitable lynx habitat (Aubry et al. 1999).

Snowshoe hares are the primary prey, making up anywhere from 35% to 97% of lynx diet. Preferred lynx foraging habitat consists of dense young conifer growth—either in early seral stands or in mature forest understories—that provides cover and browse for hares (Koehler 1990). Koehler and Brittell (1990) recommend that seedling/sapling stands in the lodgepole/subalpine fir zone be well dispersed to provide optimal lynx foraging. In the mountains of Montana and further south, lynx prey on a wider diversity of species than northern populations due to lower hare densities and different small mammal communities. Potential alternate prey includes red squirrels, jackrabbits, cottontails, and grouse.

On the Helena NF, the most robust lynx habitat and resident population is in the Blackfoot landscape of the Lincoln Ranger District. The Divide landscape supports a sparse but apparently persistent population. While some of these animals are probably transients, winter tracking surveys backed by DNA analysis of scat and hair over a 7 year period (2005-2012) indicates that others are long-term residents (Gehman 2006; Gehman *et al.* 2007-2012; Pilgrim 2009-2012; Pilgrim and Schwartz 2007-2008).

Lynx Management

Management Direction

The Canada lynx was listed as a threatened species in 2000 and is now managed via the *Northern Rockies Lynx Management Direction* (*NRLMD)* (USDA 2007a, 2007b, 2007c, 2007d), which has been amended into Forest Plans in the northern Rockies.

Four of the standards in the Lynx Management Direction address vegetation management projects, which are relevant to the current project: Standards VEG S1 and VEG S2 limit the total amount of lynx habitat that can be subjected to vegetation management in an LAU within a given time period; standard VEG S5 limits thinning in young conifer stands that provide winter snowshoe hare habitat; and standard VEG S6 limits vegetation projects in mature multilayered stands that provide winter hare habitat. Also applicable is standard ALL S1, which requires that vegetation management projects maintain habitat connectivity for lynx. While the project prea is in a linkage area (USDA 2007a) none of the linkage area standards (LINK) are applicable to the project.

Lynx Analysis Units (LAUs)

The basic units for analyzing the effects of management actions on lynx are *lynx analysis units* (LAUs)—areas about the size of individual female lynx home ranges. The Red Mountain Flume Chessman Reservoir Project Area and treatment units fall into two of the 6 LAUs that cover the Divide landscape.

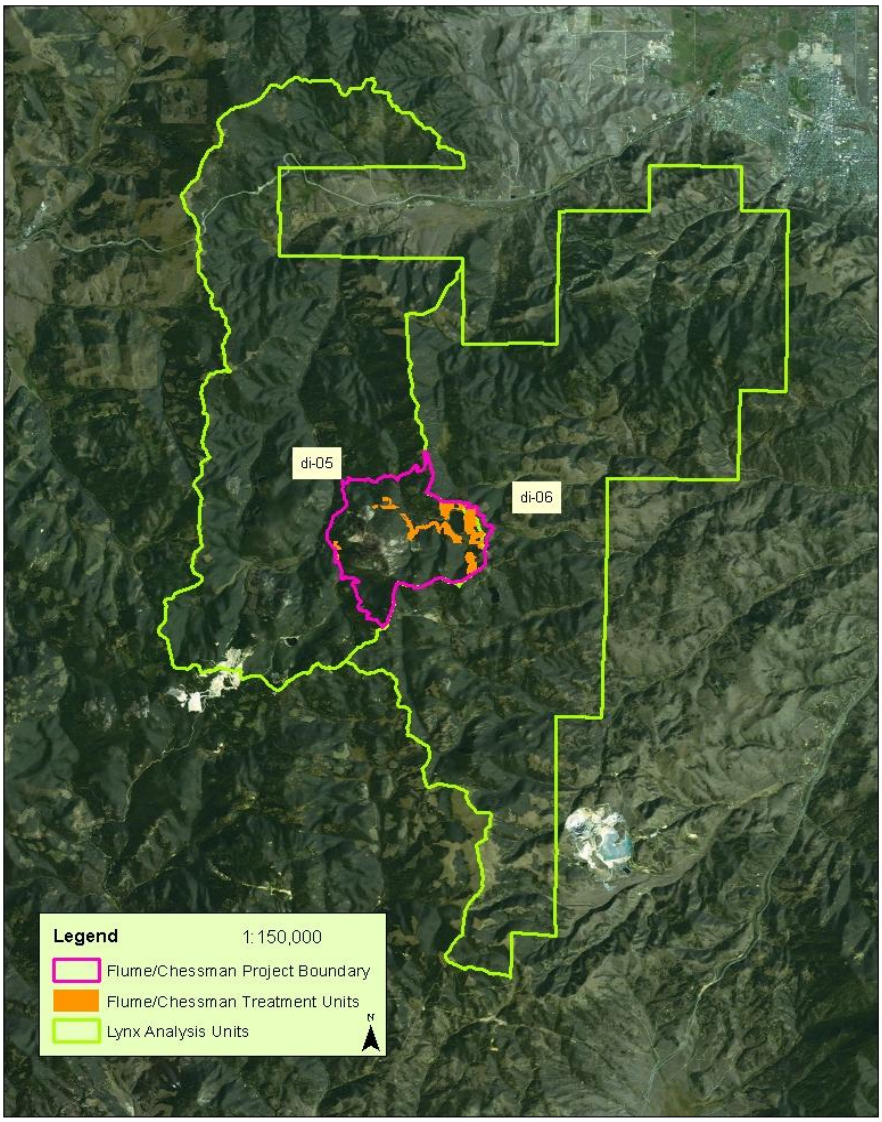


Figure 20: Lynx analysis units di-05 and di-06 in the southeastern quadrant of the Divide landscape. LAU di-05 covers the upper Tenmile Creek drainage; LAU di-06 covers the Clancy-Unionville area southwest of Helena. As can be seen, only the far eastern edge of the Project Area and treatment units extend into LAU di-06.

Table 35: Lynx analysis units (LAUs) that overlap the Flume Chessman Project Area.

LAU	LAU location	LAU total acres	potential lynx habitat acres	% of the LAU in lynx habitat
di-05	Tenmile Creek Drainage	36,530	16,632	45.5 %
di-06	Clancy-Unionville Area	46,485	12,512	26.9 %
Combined		83,015	29,144	35.1 %

Please refer to the Wildlife Background Report (Costain 2013) for the details on delineating Lynx habitat, occupied habitat, and critical Lynx habiat.

No-Action

The no-action would maintain existing condition and allow current trends to proceed with incidental human-induced habitat modification. In the short-term, the current distribution of functional snowshoe hare habitat (winter and summer), denning sites, and travel habitat would remain intact in the project area and the 2 surrounding LAUs. As is evident, these habitat components cover a relatively small proportion of the area and are highly fragmented. *Potential lynx habitat* (moist conifer forest habitat types above 5,500 ft) covers roughly 60% of the project area [with much of Red Mountain and non-Forest lands toward Tenmile Creek being non-lynx habitat]. However, the structure of most potential habitat is currently unsuitable to support snowshoe hares in winter. Typical forest structure across the area is mature single-storied lodgepole pine with little coniferous understory capable of sheltering hares.

In spite of the apparent dearth of suitable key habitat in these LAUs, systematic winter tracking surveys, long-term MFWP survey routes, and a variety of fortuitous field observations have shown that lynx are consistently present along the Continental Divide south of U.S. Highway 12, ranging well into LAU di-05. Lynx are occasionally reported in di-06, as well—some of the observations coming from the upper reach of Lump Gulch and Quartz Creek east of Chessman Reservoir.

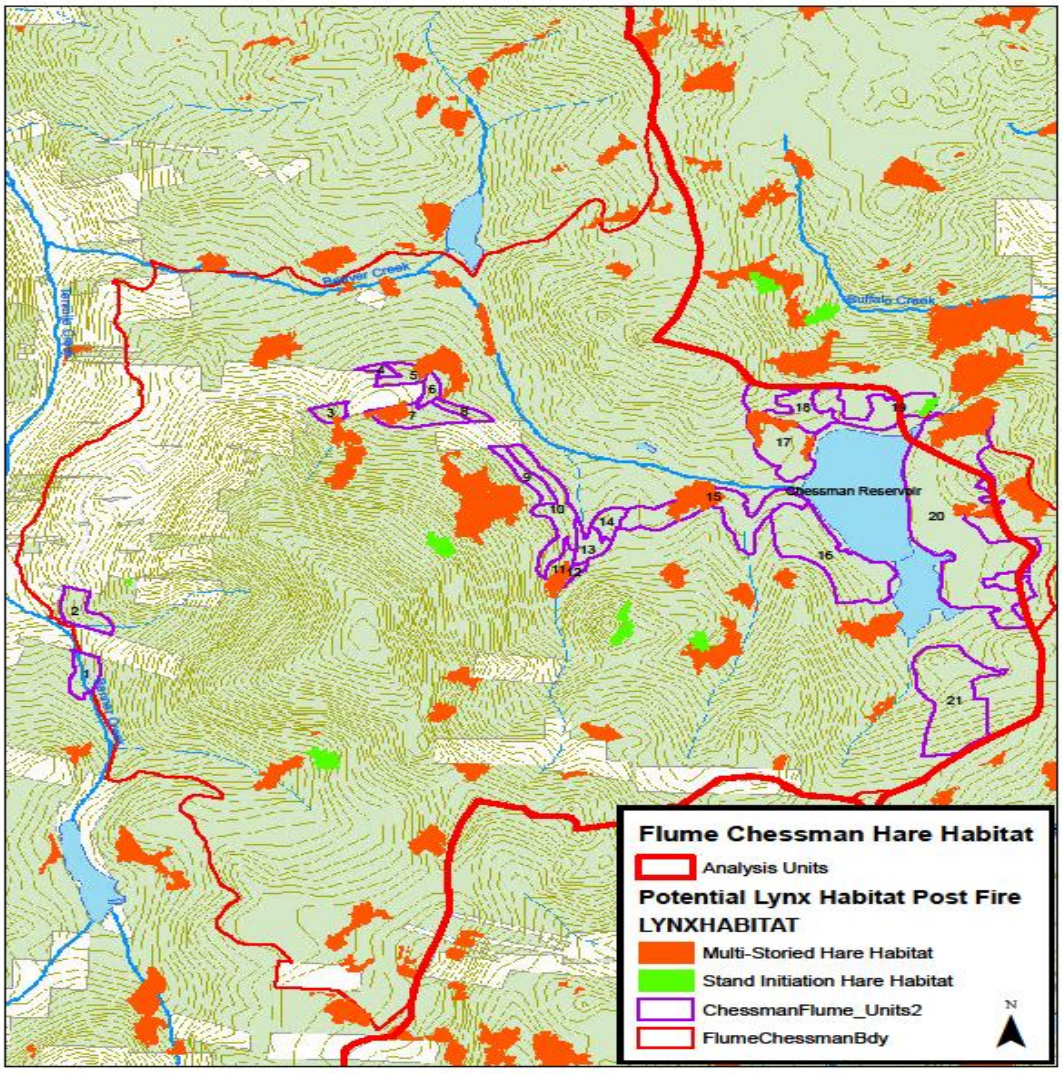


Figure 21: Distribution of multi-storied and stand initiation snowshoe hare habitat in and around the Red Mountain Flume Chessman Reservoir Project Area.

Table 36: Acres of Mapped Lynx Habitat in LAUs di-05 and di-06.

LAU	multi-storied hare habitat	multi-storied *not* hare habitat	stand initiation hare habitat	unsuitable habitat	other habitat	total potential lynx habitat
di-05	1,617	271	44	39	14,661	16,632
di-06	1,177	290	44	11	10,990	12,512
combined	2,794	561	88	50	25,651	29,144

Since 2005, Wild Things Unlimited of Bozeman has run winter track surveys over a wide area north and south of MacDonald Pass, with survey work concentrated in the period 2006-2011. Most fieldwork has been done in the Little Blackfoot and Telegraph drainages, but areas in the upper Tenmile drainage have been surveyed as well (particularly in Minnehaha Creek). Surveys involve systematic back-tracking and collection of hair, scat, and urine samples, which are then sent to the USFS Rocky Mountain Research

Station in Missoula for DNA analysis [see Gehman 2006; Gehman *et al.* 2007-2012; Pilgrim 2009-2012; Pilgrim and Schwartz 2007-2008]. DNA analysis allows identification of species and individual animals. Behavior patterns deciphered during 5 seasons of tracking, coupled with the fact that at least 2 lynx have been present for multiple years (one male for 4 years), is a strong indication that some of these animals are local residents rather than transients lingering in the area as they make their way through a linkage zone. These lynx are known to range into the Tenmile Creek drainage, although they have been not tracked as far east as the Red Mountain–Chessman Project Area.

Currently, both LAUs di-05 and di-06 are in compliance with *Northern Rockies Lynx Management Direction* (*NRLMD)* standard VEG S1, which restricts regeneration harvest in LAUs where more than 30% of the land base is in a stand initiation stage. Data for the Combination Area (which covers the same ground as LAUs di-05 and di-06, plus some additional elk herd unit area) currently shows about 9% of its area in early seral forest stages (up to large saplings). This is well below the 30% threshold. Given that Alternative 1 involves no active vegetation management, it would comply with all other standards and guidelines of the *NRLMD.*

As with much of lynx habitat in LAUs di-05 and di-06, forest structure in the project area is in a state of flux. Most lodgepole pine canopy trees have lost all foliage, resulting in a notable modification of multi-storied forest layering. To what extent lynx still perceive the needleless overstory as "forest cover" and how the change may be altering their habitat use patterns, if at all, is not clear. Under Alternative 1, the primary habitat trend in the next decade throughout much of the project area would be the methodical collapse of the dead tree overstory. Understory components useful as winter habitat for snowshoe hares (thickets of conifer regeneration) would remain intact, but whether the hares would continue to use them in winter and whether lynx might forage there in the absence of forest overstory remains to be seen. Although lynx much prefer to operate in denser forested environments, they are known to make use of lightly canopied and uncanopied sites with heavy concentrations of woody debris and only patchy conifer regeneration [see review in Moen and Burdett 2009, p. 4-8; personal observation, Kootenai NF]. These sites would not only continue to support snowshoe hares (at least in summer), but they may also serve as denning sites.

Proposal

The proposal would treat approximately 490 acres. It would (1) remove all dead trees and woody debris from a 300 ft wide corridor on either side of the Red Mountain Flume and (2) remove most dead trees and the bulk of the woody debris from a broad swath around Chessman Reservoir and its meadows. The immediate result in both cases would be "open" habitat with relatively little forest cover. Viable understory conifers and scattered overstory trees would be left intact in both areas, and riparian snags and other large snags would remain in the Chessman Reservoir units. Over the long term, both areas would be allowed to regenerate, but would be maintained as relatively open-grown forest—with the stands around Chessman Reservoir being denser. In the meantime, untreated stands surrounding the treatment units would be dominated by heavy accumulations of large woody debris with scattered surviving overstory trees and clumps of young conifers. These new habitat conditions would have obvious implications for lynx—at least locally.

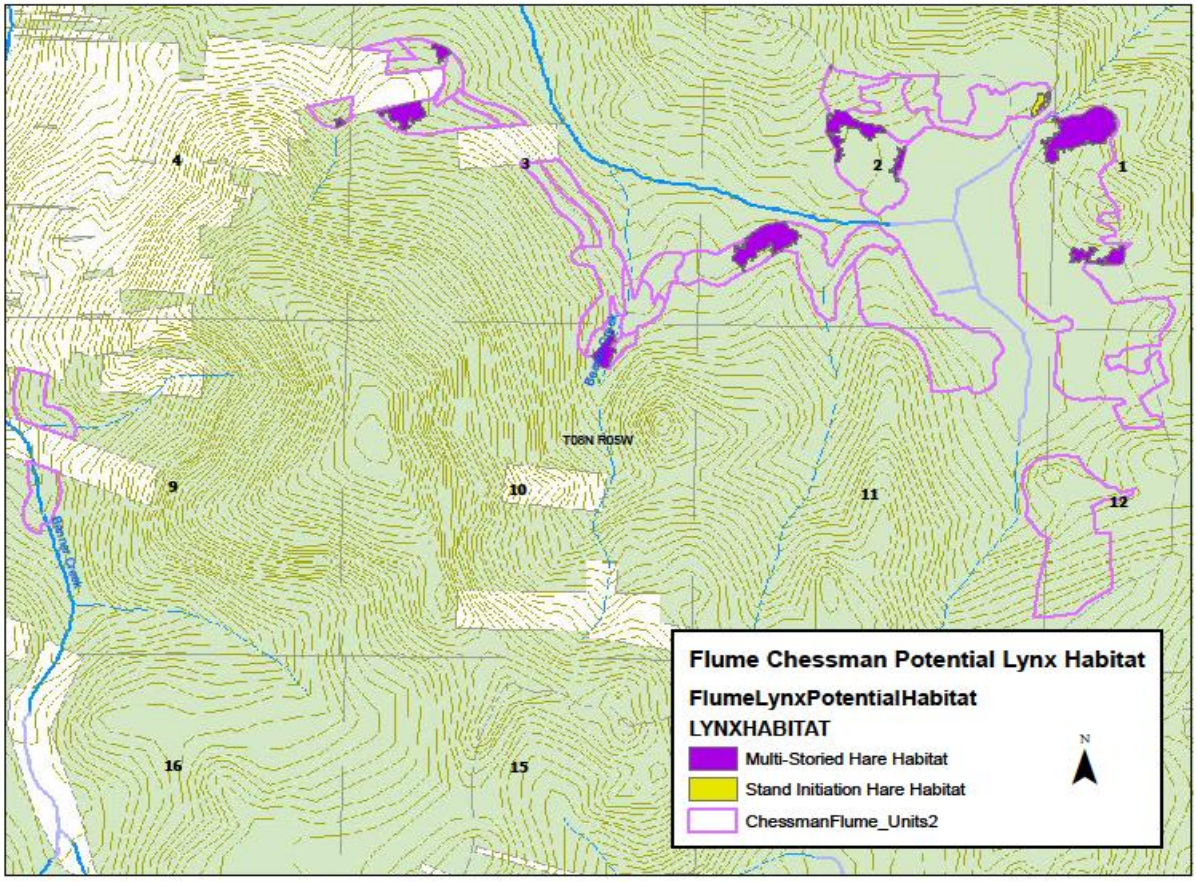


Figure 22: Stand initiation and mature multi-storied snowshoe hare habitat in the proposal treatment units.

Habitat modeling indicates that 35 acres of the area to be treated in the 15 treatment units qualifies as multi-storied mature forest suitable as winter snowshoe hare habitat. These sites are scattered throughout the units in relatively small blocks. Only 1 acre—part of a small clearing north of Chessman Reservoir—qualifies as stand initiation hare habitat. In mature forest stands, the key structures that provide snowshoe hare with effective winter cover are the thickets of young understory conifers. Removal of the dead tree overstory in Alternative 2 would leave much of this regeneration intact, but without the supporting cover offered by the overstory. Field observation of other such habitat in this area suggests that many of these uncanopied thickets would be used by snowshoe hares in summer. But whether they would be useful as winter cover is uncertain.

Regardless of the degree to which snowshoe hares continue to use the former forest understory, *NRLMD* standard VEG S6 states that vegetation management projects that reduce snowshoe hare habitat in mature and late successional, multi-storied forest are not allowed—with certain exceptions (USDA 2007b, Attachment 1, p. 4). Because the Flume Chessman project is a fuels treatment project that would occur within the wildland-urban interface (WUI), it qualifies as one of the exceptions. The wildland-urban interface in the Divide landscape encircles each area of concentrated human settlement

as a series of 4 concentric zones: the central core of each WUI is classified as a "high risk" zone, and the risk declines with increasing distance from the central zone. The flume and reservoir both lie within a core "high risk" zone that emanates from the town of Rimini in the bottom of Tenmile Creek. As a result, the proposal would comply with standard VEG S6. For similar reasons, it would also comply with standard VEG S5, with regard to precommercial thinning in stand initiation habitat (of which there is only 1 acre in the treatment units).

Alternative 2 complies, as well, with guideline VEG G10, which directs that projects be designed with standards VEG S1, VEG S2, VEG S5, and VEG S6 in mind, so as to promote lynx conservation. In designing Alternative 2, we considered standards VEG S1, S2, S5, and S6: the project would comply completely with standards VEG S1 and S2 but would slightly reduce mapped snowshoe hare habitat covered under standards S5 and S6. Given the meager acreage of hare habitat involved (one acre under standard VEG S5 and 35 acres under standard VEG S6) and the importance of meeting the project's purpose and need, we felt that the impact to lynx would be insubstantial and application of the WUI exemption justified. As per standard VEG S6, this is allowed for up to 6% of the lynx habitat on the HNF. The NRLMD (2007) allows the HNF to treat 26,400 acres in this way, and to date, only 78 acres have been treated. With the addition of the habitat loss under Alternative 2, the total would be 114 acres—about .025% (that is, less than 3/100 of 1%) of the allotted area.

Compliance of the proposal with the relevant standards and guidelines of the *Lynx Management Direction* (USDA 2007b, Attachment 1, p. 1-9) is summarized in the *Table* below.

Table 37: Compliance of the proposal with applicable standards of the *Northern Rockies Lynx Management Direction.* Because this management direction has been amended into the *Helena Forest Plan*, the results summarized here also serve as *Forest Plan* compliance.

***NRLMD* Standard**	**Standard Requirement**	**Does Alternative 2 Meet the Standard?**
ALL S1	*New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area.*	*The standard is met:* The treatment area would form a relatively compact string of openings in the center of the Beaver Creek drainage. The flume portion of the area would be only 600 ft wide and easily crossed. Untreated mature forest would surround the treatment units and provide a variety of ways for lynx to bypass the treatment units when moving through the area. The project would not impede the ability of lynx to move through the Project Area or the surrounding LAUs.

NRLMD Standard	Standard Requirement	Does Alternative 2 Meet the Standard?
VEG S1	*Unless a broad scale assessment has been completed that substantiates different historic levels of stand initiation structural stages, limit disturbance in each LAU as follows: if more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.* *In addition, fuels treatment projects may not result in more than 3 adjacent LAUs exceeding the standard.*	*The standard is met:* In both LAUs di-05 and di-06, stand initiation structural stages too young to provide viable winter snowshoe hare habitat account for far less than 30% of the lynx habitat (<8% in the two LAUs). This allows vegetation management projects that aim to harvest and regenerate forest stands to go forward.
VEG S2	*Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands within an LAU in a ten-year period.*	*The standard is met:* Technically, the standard does not apply in this case. While treatment units will be regenerated as open forest stands, the primary purpose of treatments along the flume and around Chessman Reservoir is to remove dead trees and maintain fire-breaks rather than to regenerate original stand structure. Regeneration harvest is defined in the *NRLMD* as *"the cutting of trees and creating an entire new age class; an even-age harvest".* In any event, proposed cutting would not bring the total of early seral habitat in the LAUs anywhere near 15% in 10 years (<6% in the two LAUs).
VEG S5	*Precommercial thinning projects that reduce snowshoe hare habitat may occur from the stand initiation structural stage until the stands no longer provide winter hare habitat only (1) within 200 feet of administrative sites; (2) for research studies; (3) based on new, peer reviewed information; (4) for aspen improvement; or (5) for whitebark pine restoration. Projects that use precommercial thinning as a tool for fuels treatment within the wildland-urban interface (WUI) are excepted.*	*The standard is met:* Treatment units include only 1 acre of stand initiation hare habitat—which would be thinned for the purpose of reducing fuel loading, rather than as a precommercial thinning operation. Precommercial thinning is defined in the *NRLMD* as *"mechanically removing trees to reduce stocking and concentrate growth on the remaining trees and not resulting in any financial return."* The proposed fuels treatment area lies within a "high risk" zone of the WUI and is therefore exempt from the standard.

NRLMD Standard	Standard Requirement	Does Alternative 2 Meet the Standard?
VEG S6	*Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late-successional forests may occur only (1) within 200 feet of administrative sites; (2) for research studies; or (3) for incidental removal during salvage harvest. Fuels treatment projects within the wildland-urban interface (WUI) are exempt from the standard.*	*The standard is met:* HNF lynx habitat modeling indicates that proposed treatment units include 35 acres of multi-storied, mature forest snowshoe hare habitat. However, because the project is a fuels treatment effort and falls within a "high risk" zone of the WUI, it is excepted from the standard. The NRLMD allows up to of 6% of lynx habitat on the HNF to be treated under the WUI exception. As per the NRLMD (2007), the HNF is allowed up to 26,400 acres of such fuels treatments; and to date 118 acres have been treated—a total of .025% of the Forest.
VEG G10	*Fuel treatment projects within the WUI as defined by the HFRA (Healthy Forests Restoration Act) should be designed considering Standards VEG S1, S2, S5, and S6 to promote lynx conservation*	The guideline is met: In designing Alternative 2, we considered standards VEG S1, S2, S5, and S6 in order to promote lynx conservation but determined that in order to meet the purpose and need of the project one acre needed to be exempted from VEG S5 and 35 acres needed to be exempted from VEG S6. As discussed under standard VEG S6, this is allowed for up to 6% of the lynx habitat on the HNF. As per the NRLMD, the HNF is allowed to treat 26,400 acres under the WUI exception; and to date only 118 acres have been treated—less than 3/100 of 1% of the Forest.

The Project Area also lies within a zone that the *NRLMD* has mapped as a linkage area (USDA 2007a). However, none of the linkage area standards and guidelines (LINK S1, LINK G1, LINK G2) apply to the kind of activity proposed in Alternative 2 (USDA 2007b, Attachment 1, p. 8).

In terms of actual snowshoe hare habitat use in and around project treatment units, it is likely that the hares would continue to use surviving thickets of conifer regeneration as cover when foraging on reinvigorated ground vegetation in the new openings during spring, summer and fall. They are probably less likely to frequent these sites in winter without the added protection of forest overstory and given their relatively fragmented distribution. Locally, hares would be most likely to find viable winter habitat in (1) regeneration thickets in the surrounding mass of, which would provide some added overhead protection and snow interception, (2) patches of green, multi-storied Douglas-fir, Engelmann spruce, and subalpine fir throughout the Project Area, and (3) the array of 15-30 year old sapling-filled clearcuts in the Buffalo Creek, Lump Gulch, and Quartz Creek drainages in di-06 just to the east.

Because the project area lies south of U.S. Highway 12, it is *not* classified as "critical habitat" for lynx by the USFWS and thus is not subject to the constraints imposed by potential impacts to "primary constituent elements" (PCEs). It should be noted, however, that were PCE standards applied to the project area, all primary constituent elements would remain functional under the proposal. Primary changes to lynx and hare habitat would be due to natural events in the aftermath of the mountain pine beetle outbreak and not to fuels treatments proposed in proposal. The proposal would be consistent

with all standards and guidelines in the *Northern Rockies Lynx Management Direction* and therefore with the *Helena Forest Plan.*

Cumulative Effects

The cumulative effects analysis areas for lynx are (1) the 2 local lynx analysis units—LAUs di-05 and di-06 (83,015 acres)—and (2) for some activities, the Combination Area (136,105 acres).

The *Canada Lynx Conservation Assessment and Strategy* (*CLCAS)* (Ruediger et al. 2000)—the initial management guidance for the newly listed lynx—discusses a number of risk factors for lynx. Factors affecting lynx productivity are timber management, wildland fire management, recreation, forest roads and trails, livestock grazing, and other human developments. Risk factors affecting lynx mortality are trapping, predator control, incidental or illegal shooting, competition and predation as influenced by human activities, and highways. Factors affecting lynx movement are highways, railroads, and utility corridors; land ownership patterns; and ski areas and other large resorts. Other large-scale risk factors are fragmentation and degradation of lynx refugia, lynx movement across shrub-steppe habitats, and habitat degradation by invasive plant species. These risk factors are taken into account in this summary of cumulative effects.

Every one of the lynx risk factors listed above has come into play in the Divide landscape over the course of the last century, and most have had an influence within the cumulative effects area as well (the exceptions being the presence of ski areas and resorts, railroads, and possibly incidental shooting)

The primary activities that have disrupted lynx in the cumulative effects area have been the (1) removal of forested cover by timber harvest; (2) the construction of roads and trails, which have fragmented lynx refuge habitat and facilitated trapping and recreation; and (3) the establishment of other human developments, such as dwellings, mines, campgrounds, and so on.

Timber harvest and fuels project have produced a mixed bag of outcomes for lynx. The loss of mature forest with functional snowshoe hare habitat, particularly in lodgepole pine community types, is followed predictably by the formation of stand initiation habitat and a different kind of environment for hares and lynx. But in the meantime, there is a gap of generally 15-20 years in which the area is not suitable as winter hare habitat and does not provide enough forest cover for lynx

Timber harvest units in lynx habitat produced prior to 1980, are now mostly in the “stem exclusion structural stage” in which single-storied stands of mature or pole-sized trees exclude the development of understory conifers and shrubs—habitat that lynx may use for travel but not for foraging or denning . Since 1980, timber harvest and fuels treatment activity in the Combination Area have created early seral habitat or open forest habitat with some sort of early seral understory on an estimated 12, 509 acres on HNF land in the Combination Area (*Table 19*). While the nature of fuels treatment areas is highly variable, it is likely that the dominant feature of most of them is still in some sort of early seral structural stage. The timber harvest units are more predictable. Combined, these sites account for about 9% of the Combination Area, and we assume that they occur on a similar proportion of lynx habitat within the 2 local lynx analysis units as well. This percentage is well below the threshold of stand initiation structural stages per LAU allowed by *NRLMD* standard VEG S1 (30%). The percentage of new early seral

habitat since 2000 is about 6% of the area, which is well below the 15% new regeneration harvest allowed under standard VEG S2.

Table 38: Timber harvest and fuels treatment activity on HNF land in the Combination Area (136,105 acres) since 1980. These are areas that are most likely to be in stand initiation structural stages or some other form of early seral habitat condition.

Decade	Timber Harvest acres	Likely vegetation structure in timber harvest units	Fuels Treatment Acres	Likely vegetation structure in fuels treatment harvest units
1980–1989	1,195	mid to large-sized sapling conifers	866	open-grown forest with some mid-large sized sapling conifers
1990–1999	477	small to mid-sized sapling conifers	1,551	open-grown forest with some mid sized sapling understory
2000–2009	749	seedling conifers / grasses & forbs	3,541	open-grown forest with seedling conifer understory
2010–2013	888	developing grass & forb cover	3,242	open-grown forest with grass/forb understory
Total	3,309	stand initiation seral stages	9,200	stand initiation seral stages

Timber harvest since 1980 has created clearcuts of all sizes, and wherever seral communities dominated by dense sapling conifers have developed in potential lynx habitat in the Combo Area and in LAUs di-05 and di-06, viable snowshoe hare habitat has emerged. These harvest units have created a mosaic of early and later successional habitats across the landscape—an arrangement generally more favorable to lynx than an unbroken sea of mature/pole forest.

Timber harvest on private land has impacted lynx, primarily via degradation of foraging habitat. It is unlikely that lynx inhabit most adjacent non-Forest lands because of their low elevation and prominence of dry forest and non-forest habitat types. Inholdings at higher elevation often qualify as potential lynx habitat. Many have been logged in the last 30 years and are in various stages of succession—most of them not favorable to lynx because of erratic regeneration. Others are in the process of being cleared of most standing timber that has been killed in the ongoing bark beetle outbreak. Where lodgepole pine is the dominant overstory, there is some potential for future development of stand-initiation hare habitat.

Roads and trails have also had an impact, primarily as conduits for trapping that continued to limit lynx populations to small remnants across the HNF through the 1990s. Roads are particularly problematic when they pass through key lynx habitat (saddles, forested stringers, riparian areas, denning habitat). Since the 1960's some of these roads have also become snowmobile routes, allowing recreationists access to winter lynx habitat and creating packed routes for other carnivores that compete with lynx.

The USFWS, using the best scientific and commercial data available has found no information to indicate that management of grazing allotments is a threat to lynx at this time (USDA 2007d, p. 276). While this information does not indicate that grazing is a threat to lynx conservation and recovery at this time, adverse effects to individual lynx could result from grazing activities simply by virtue of its allowing large numbers of cattle to continue impacting HNF resources that may be of use to lynx and, more importantly, to primary lynx prey (snowshoe hares). On the other hand, revision of allotment management plans over the past 2 decades has reduced cattle numbers and spawned a variety of range

improvements aimed at protecting riparian sites. These projects have conspicuously improved vegetation condition in many riparian and other wet sites, restoring foraging opportunities for lynx.

Actions that have improved prospects for lynx include: Closure of Inventoried Roadless Areas to snowmobiles (Lazyman Gulch); initiation of the Statewide OHV Plan (2001), which prohibits riding off established motor routes; road and motor trail closures associated with timber harvest projects that have expanded blocks of non-motorized habitat (Clancy-Unionville, Lava Mountain).

Two reasonably foreseeable actions with implications for lynx in the Combination Area are (1) the Divide Travel Plan, which proposes a variety of area closures and changes to current vehicle routes, some of which would reduce vehicle access into lynx habitat, and (2) the Telegraph Vegetation Project, which would remove dead trees and thin young conifer stands on >6,000 acres just west of the Continental Divide, reducing the effectiveness of some current multi-storied hare habitat (but staying out of stand initiation hare habitat).

Human activities with the greatest cumulative impact on lynx habitat have been timber harvest/fuels treatments and construction of roads and motor trails. Timber harvest and fuels treatments on HNF land in the cumulative effects area have opened up around 10,000 acres of forested habitat since 1960 (accounting for overlap between fuels and timber harvest acres)—probably about 40% of it in lynx habitat. After a hiatus of 15-25 years in which these sites were unsuitable as lynx foraging habitat, a majority of these stands are now in some sort of stand initiation structural stage capable of supporting snowshoe hares. The primary large vegetation management operation proposed in the Combination Area, the Telegraph Vegetation Project, would affect lynx habitat by removing dead overstory trees form several areas of multi-storied hare habitat.

Roads and motor trails have fragmented lynx habitat refuges and allowed snowmobiles to create packed routes for competing carnivores into lynx winter habitat. While in the past these roads also facilitated access for trappers on snowmobiles, legal lynx trapping was eliminated in 1999. Over the last 25 years the number of open roads on HNF land in the Combination Area has declined via road closures. All currently developed action alternatives of the proposed Divide Travel Plan would close more of these routes and would close a number of areas to off-route snowmobiling in the Combination Area and LAUs di-05 and di-06.

Retention of current conditions and trends around Chessman Reservoir and the Red Mountain Flume under the no=actionwould not add to cumulative effects generated by past, ongoing, or reasonably foreseeable human activity in the short term; nor would it change the outcome expected in the aftermath of the mountain pine beetle outbreak.

The removal of dead overstory trees from 35 acres of multi-storied hare habitat in the Red Mountain Flume Chessman Reservoir Project Area under the proposal would not add to past, on-going, and reasonably foreseeable cumulative effects in a way that would significantly impact the ability of lynx to inhabit the cumulative effects area. After another 5-10 years, the overstory in most stands surrounding the treatment units would be gone as well—although it would probably be more functional as hare habitat, give the accumulation of coarse woody debris.

Forest Plan Consistency

The *Helena Forest Plan* as released in 1986 had no objectives, standards, or guidelines addressing Canada lynx. As of 2007, however, the management guidance of the *Northern Rockies Lynx Management Direction (NRLMD)* has been amended into the *Plan* (as it has been into all Forest Plans in Region 1). Adherence to objectives, standards, and guidelines of the *NRLMD* (USDA 2007b, Attachment 1, p. 1-15) is thus equivalent to *Forest Plan* compliance.

Five standards are relevant to the proposal : Standards, ALL S1, VEG S1, VEG S2, VEG S5, and VEG S6. As discussed previously, the proposal would comply with the requirements of these standards.

Northern Goshawk

Goshawks are the only large diurnal raptors adapted to interior forest environments in the northern Rockies. Common elements of goshawk habitat are extensive blocks of older forest with tight groups of mature nesting trees, abundant prey (squirrels, hares, larger songbirds, grouse), and mid-level flyways. In the northern Rockies, *optimal* habitat for goshawks is provided by old-growth Douglas-fir and ponderosa pine forest. Since the 1980s, copious field research and survey work have shown that goshawks are more versatile in their use of habitat than was believed when the Forest Plans were written. Goshawks have specific requirements for nesting and post-fledging habitat (closed-canopied mature forest) but otherwise have been shown to be forest generalists—and not particularly useful as Douglas-fir old-growth indicators (Braun et al. 1996; Reynolds et al. 1992; Clough 2000; McGrath et al. 2003).

Surveys over the past 15 years on the Helena, Beaverhead-Deerlodge, Lewis and Clark, and Medicine Bow National Forests have found that goshawks will nest and forage in stands of mature lodgepole pine as long as the basic structural attributes they need are in place and prey is adequate (Lemke 1993; Squires and Ruggiero 1996; Clough 2000). In the more fragmented forest environments east of the Continental Divide where mountains and plains intermingle, goshawks often occupy mosaics of forest and grassland or a mixture of different forest seral stages. They are drawn also to aspen stands because of the robust populations of potential prey these habitats support (grouse, cottontails, snowshoe hares, ground squirrels, mourning doves, flickers, small owls, and numerous large songbirds and woodpeckers). Goshawks are capable of foraging through open parks and woodlands and along forest edges. In certain circumstances, they do so on a regular basis (Younk and Bechard 1994). But regardless of the structural diversity of foraging habitat and of goshawk ranges in general, nesting and post-fledging habitat inevitably requires cohesive stands, or at least patches, of dense-canopied mature forest.

Squires and Ruggiero (1996) found that goshawks were adept at locating suitable microsites within lodgepole pine stands that otherwise did not appear to be suitable nesting habitat. This was further substantiated in McGrath et al. (2003), who found that many of their sampled goshawks were nesting in non-typical habitat to the extent that the researchers were unable to differentiate between actual nests and random locations in a “blind sample comparison.” In Nevada, Younk and Bechard (1994) studied goshawks that nested in aspen stands and preyed mostly on ground squirrels in shrub-steppe habitat.

Extensive survey work over the past 18 years has demonstrated that goshawks are widespread across the HNF. They maintain large home ranges, estimated at around 5,000-6,000 acres per pair (Reynolds et al. 1992; Clough 2000); and, as a result, population densities are naturally low, even where suitable habitat is abundant. In areas with high prey populations and optimal habitat structure, home ranges may be smaller or overlap. Goshawks can hunt through a diversity of habitat formations as long as prey is adequate, and most of a goshawk home range consists of foraging habitat and inclusions of unsuitable habitat (Reynolds et al. 1992). Nesting stands and post-fledging areas (PFAs), which require more specialized habitat structure, make up a much smaller portion of the home range—usually no more than a few hundred acres. On the HNF, nest sites and surrounding PFAs sometimes cover less than 100 acres. These are forested areas dominated by mature trees with enough closed canopy to provide screened nesting sites, suitable microclimate, abundant prey, and security from open-forest predators.

Loss of habitat to clearcut logging, stand-replacing fire, and other agents of canopy fragmentation are primary threats. Goshawks are sensitive to human disturbance of nest sites and can be very aggressive in defending the nest and the larger area within which newly fledged young are operating (post-fledging area) [personal observation, Helena and Beaverhead-Deerlodge National Forests 1987-2012]. They may occupy the same nest stand in consecutive years but rarely the same nest (although they may return to an old nest 2 or 3 years later). Just as often, they may move to a new stand elsewhere in the home range. Because of their large home ranges and their natural tendency to cycle among different nest sites between years, they are able to adapt too many environmental changes (such as fire, timber harvest, and insect outbreaks) by moving to adjacent undisturbed sites.

No-Action

The no-action would retain the status quo along the Red Mountain and around Chessman Reservoir. Predominant habitat condition and future trends would thus be primarily a function of what follows in the wake of the mountain pine beetle outbreak.

Over the past 2 decades, fieldwork in the Combination Area has located and cataloged a number of active goshawk nests or centers of activity. [A “center of activity” is an area where goshawk behavior indicates that a nest is present nearby, although the nest itself has not been located]. Occupied goshawk nest stands were found to be regularly spaced, roughly 3-4 miles apart, across most of the predominantly forested part of the area. In those cases where larger gaps existed between nest sites and suitable habitat appeared to be available, it was hypothesized that nests ought to be located there: In some cases follow-up fieldwork actually found nests in those locations, in others they did not. A spacing of about 3 miles would be the expected inter-nest distance if goshawks were occupying non-overlapping home ranges of about 5,820 acres, as described by Reynolds et al. (1992).

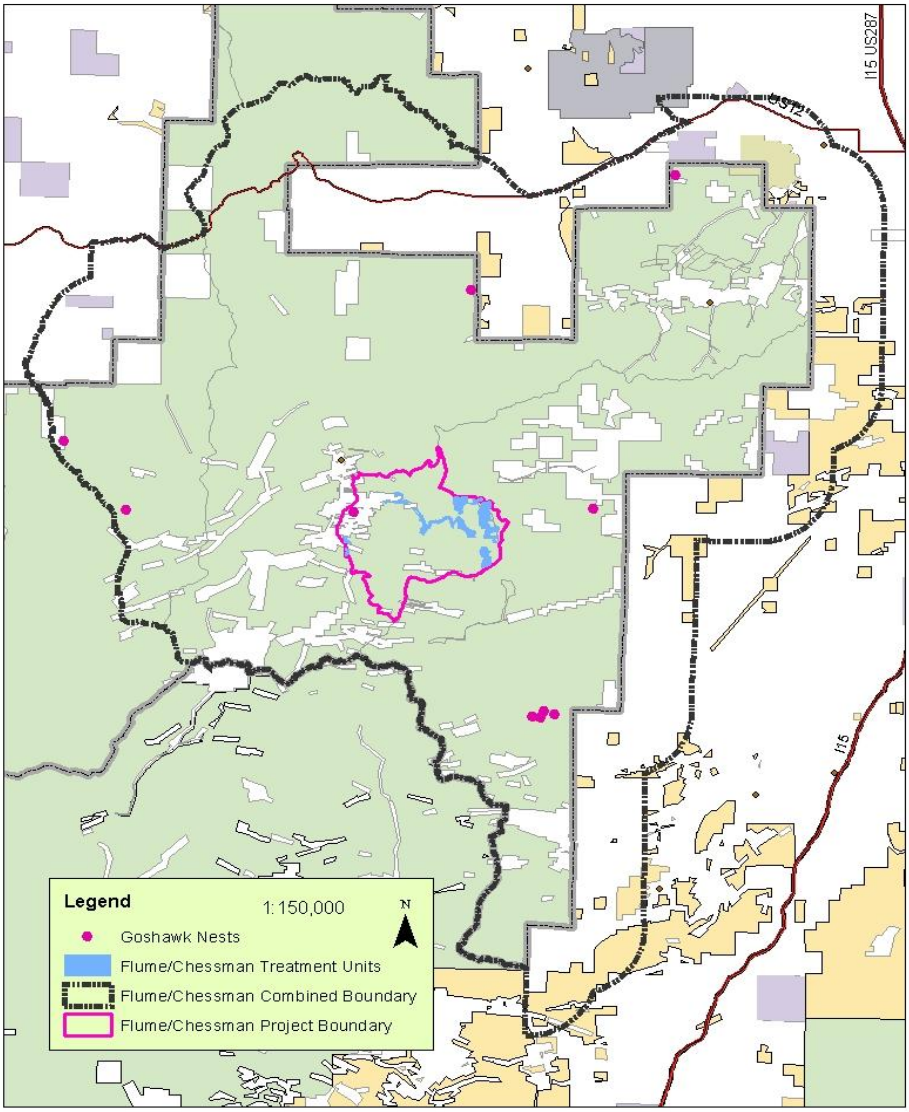


Figure 23: Known goshawk nests in the Combination Area as of summer 2012. Several more nests than these have been located in this area over the past 2 decades, but these are nests that have been found to be active over the last 5 years.

As in the past, not all areas have been surveyed, but there are more gaps in the dispersion pattern than prior to the beetle irruption. Before the beetle-induced loss of forest foliage, the goshawks that we monitored changed nest sites each year but, in most cases, remained within the same nest stand complex—typically nesting somewhere between a few hundred feet to a mile away from the previous year's site. With the loss of thousands of acres of viable nesting habitat as a result of beetle-kill, suitable nest stands have become smaller and more fragmented. The choices open to local goshawks have become much more limited, particularly in terms of finding a new nest site close to the one used the year before. This, in turn, has made it more difficult for fieldworkers to relocate goshawk pairs from year to year. At this point it is difficult to know how much of the lower goshawk survey numbers are

due to the shrinkage of nesting habitat and how much is due to sampling inadequacies or to random year-to-year variation.

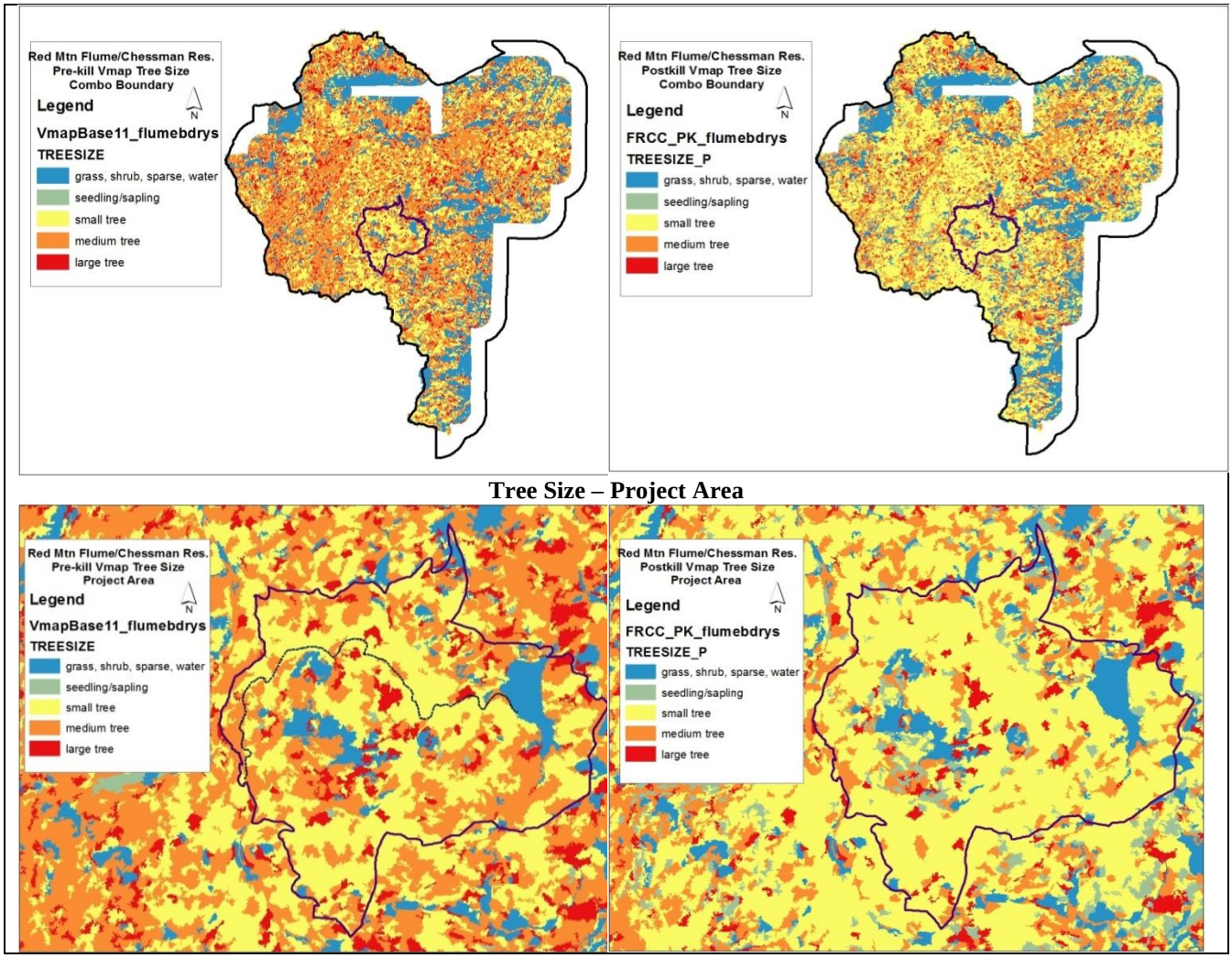


Figure 24: The loss of medium (orange) and large (red) canopy trees across Project Area and Combination Area forests as a result of the pine beetle outbreak and the consequent increase in stands dominated by small trees (yellow). In most cases, this represents a loss of potential goshawk nesting habitat. Nest sites now are found in the islands of large and medium-sized trees in the "post-kill" forest. These R1-VMAP images are from the *Forested Vegetation Report* (p. 24).

Figure 23 illustrates the shift from forests dominated by medium-sized trees (mostly lodgepole pine) to those dominated by small trees—those small enough to have escaped the mountain pine beetle (typically less than 5-6 inches dbh) along with some new regeneration that is beginning to emerge [see *Forested Vegetation Report,* p. 23-24]. Large tree stands were less impacted as they are dominated primarily by Douglas-fir, which is not affected by the beetle, or by ponderosa pine, which was not as severely impacted as lodgepole pine and thus retained a number of large trees in many stands. This loss of the medium tree canopy represents a loss of a considerable amount of potential goshawk nesting habitat. Not all stands of medium-sized lodgepole pine were suitable for goshawk nesting when the

mountain pine beetle arrived, although they may have been evolving in that direction. But at this point, with most overstory trees dead and variable amounts of young trees underneath, virtually none of these lodgepole stands has any potential as nesting habitat in the near future.

The Project Area currently supports one active goshawk breeding home range. The 2 known nest sites (from 2012 and 2013) are located toward the western end of the Project Area, and the home range probably encompasses the western half of the Project Area plus 2000-3000 acres across Tenmile and Banner Creeks further west. The resident goshawks were first located in 2012 on private land near the flume corridor [See next *Figure*] . How long this has been an active breeding range is unknown as the Tenmile drainage is one of the few areas on the HNF that has not been regularly surveyed over the last 20 years. The now inactive nest from 2012 lies near the edge of the open corridor cut by the city of Helena along this section of the flume. The nesting habitat would not have extended into the cutting unit, as this part of the stand was dominated by dead overstory trees.

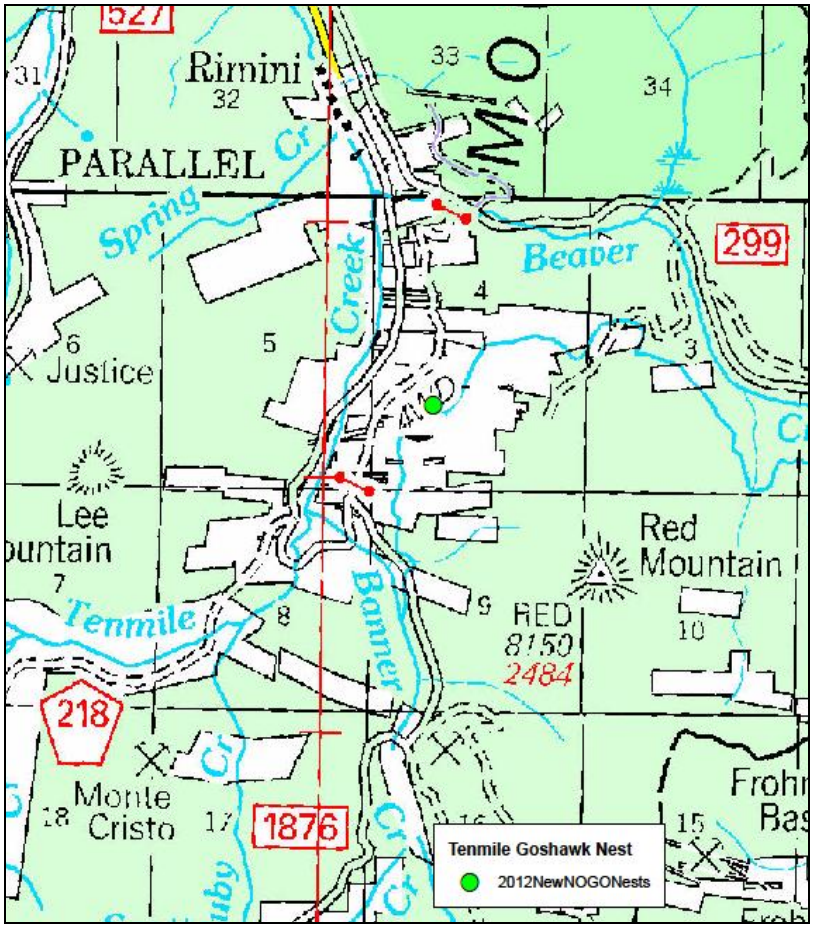


Figure 25: Location of the active goshawk nest observed in July 2012 on private land just northwest of the Red Mountain Flume. The 2013 nest (not shown) is situated about 0.25 mi west of the 2012 location near the western edge of Section 4. Both nest sites are on private land.

Inevitably, goshawks establish new nest sites each year, although on occasion, they will move into and rebuild an old nest from 2 or more years before. The 2013 nest site for the Project Area goshawks is located about ¼ mile downslope from the 2012 nest in a stand of green, mature Douglas-fir . Fieldworkers have estimated that roughly 40% of the stand overstory is composed of dead lodgepole pine. Still, the canopy is apparently sufficient to provide for nesting and post-fledging purposes. The nest site will be monitored throughout the summer to see how young birds deal with the less-than-optimal PFA conditions. This nest site will not be disturbed by any other foreseeable vegetation projects on the private holdings.

Mature lodgepole pine forests that have made up the major part of goshawk nesting and foraging habitat across the project area for several decades will continue to deteriorate. At this point, most canopy foliage is already gone from the overstory trees, so that the lodgepole pine-dominated stands are no longer functional as nesting sites for local goshawks. The stands do continue to provide viable foraging habitat, although it is less suitable than in the mature canopied forests that previously dominated the project area. For the next several decades, nesting will be limited to surviving mature stands of Douglas-fir, Engelmann spruce, subalpine fir, and possibly, aspen. These stands account for about 18% of the Project Area [*Table 20*] but only a portion of them are suitable as nesting habitat. The ability of the goshawk population to sustain itself at pre-beetle-kill levels remains to be seen. More optimal mature forest goshawk habitat will not be re-established over a majority of the area for another 80-100 years [*Forested Vegetation Report*].

Under the no-action, the likelihood of goshawks being able to maintain viable home ranges and to successfully rear young in this area would continue to be a function of their ability to deal with the new conditions imposed by the bark beetles. Observation of goshawk nest sites in the project area over the past 2 years suggests that the birds may be able to find adequate nesting habitat in remnant Douglas-fir stands and in stands of other non-pine trees, and that they will be able to forage both in those stands and in the surrounding dead tree dominated environment. Whether or not they will be able to persist once the dead trees have fallen is open to question, but fieldwork in a number of areas throughout the Rocky Mountain west suggests that they may well be able to forage in relatively “open” environments as long as perch sites are well distributed and passable nesting stands are available.

Proposal

The proposal would treat 490 acres: It would (1) remove all dead trees and woody debris from a 300 ft wide corridor on either side of the Red Mountain Flume and (2) remove most dead trees and the bulk of the woody debris from a broad swath around Chessman Reservoir and its meadows. The immediate result in both cases would be “open” habitat with relatively little forest cover. Viable understory conifers and scattered overstory trees would be left intact in both areas, and riparian snags and other large snags would remain in the Chessman Reservoir units. This would provide marginal foraging habitat for goshawks—at least while snags in surrounding stands still provided some adjacent cover and perch sites for the birds to sit and peruse the prey potential of the openings. The project would have no effect on potential nesting habitat as it would only modify stands dominated by dead trees that are no longer suitable for nesting. As is displayed on the next Table, there would be no difference in nesting habitat availability between the proposal and the current condition.

Table 39: Distribution of stands dominated by different tree size classes in the Project Area before and after proposed treatment under Alternative 2 and their utility as goshawk habitat [figures are from the *Forested Vegetation Report*, p. 23-24].

tree class	dbh	goshawk habitat	pre-beetle percent	current percent	post-project percent
small conifers	< 10 in.	potential foraging	49 %	73 %	73 %
medium–large conifers	> 10 in.	potential nesting/PFA	41%	18 %	18 %
non-forest	-	mostly non-habitat	9 %	9 %	9 %

Over the long-term, treated areas would be allowed to regenerate, but would be maintained as relatively open-grown forest—with the stands around Chessman Reservoir being denser. This would provide local goshawks with a more suitable foraging environment. In the meantime, untreated stands surrounding the treatment units would be dominated by heavy accumulations of large woody debris with scattered surviving overstory trees and clumps of young conifers. This would probably provide a more fruitful foraging environment for goshawks than the treatment units—the prey populations being denser and more diverse. Most of this new habitat configuration would not provide suitable nesting habitat. Only about 18% of the project area would support coherent patches of green, mature non-pine trees with some potential to serve as nesting and PFA areas—the same result as if no action were taken.

In essence, the proposal would have no significant effect on goshawk nesting, PFA, or foraging habitat within the local occupied breeding home range. It is no more likely to drive resident goshawks from the area than allowing current conditions to prevail and allowing ongoing natural trends to move forward throughout the entire Project Area.

Cumulative Effects

The cumulative effects analysis area for goshawks is the Combination Area (136,105 acres).

The primary human activities that impacts goshawk nesting and foraging habitat over the past century have been the removal of mature forested cover by timber harvest on both public and private lands. The extent of this activity on HNF lands since 1960 has been summarized in previous *Tables*. Since the release of the *Forest Plan* in 1986, goshawks have been singled out for special attention as management indicators, and timber/fuels projects have established mitigation measures to avoid disrupting active nest sites. Plus, natural agents have reduced goshawk habitat at various times in the last century: fire, early in the century and a Forest-wide mountain pine beetle outbreak most recently. The beetle epidemic is still in the process of radically altering habitat opportunity and habitat use patterns of goshawks throughout much of the Combination Area—and across the Forest in general. The general status of potential goshawk habitat throughout the Combination Area can be gleaned from *Table 21.*

Table 40: Distribution of stands dominated by different tree size classes on HNF land in the Combination Area before and after proposed treatment under Alternative 2 and their utility as goshawk habitat.

tree class	dbh	goshawk habitat	pre-beetle percent	current percent	post-project percent
small conifers	< 10 in.	potential foraging	35%	61%	61%
medium–large conifers	> 10 in.	potential nesting/PFA	54%	18%	18%
non-forest	-	mostly non-habitat	21%	21%	21%

As displayed in the above table, the "pre-beetle percent" shows the relative amount of habitat available around 2006, and reflects the effects of timber harvest and fuels treatment on the National Forest up to that time—several thousand acres since 1960. The "current percent" reflects both the effect of beetle-generated mortality and of timber harvest and fuels treatment since 2006. A majority of the vegetation manipulation since the start of the beetle outbreak has been in the form of fuels treatments, which have either removed already-dead trees, thinned out and removed ladder fuels from more open stands, or served as follow-up to timber harvest. Most of this treatment has thus affected goshawk foraging habitat, but not nesting habitat. The approximately 1,200 acres of timber harvest since that time has had more of an impact on potential nesting habitat. The resulting percentage of remaining potential nesting habitat is nearly identical to that in the Project Area (18%)—which should be sufficient to support a population of goshawks similar to what has been present in the Combination Area over the past 2 decades. The amount of "non-habitat" is higher in the Combination Area than in the Project Area because of the large inclusions of dry grassland and shrubland in the northern and eastern regions of the Combo Area.

The acreage of timber harvest on private inholdings and on private lands adjacent to the HNF boundary in the last 50 years has not been tallied, but it undoubtedly totals several thousand acres. Over the last 5-8 years most of this harvest has been of already-dead overstory trees, so its impact on potential goshawk nesting habitat has been minimal. Prior to that, however, a substantial amount of potential nesting habitat was removed.

Other projects in the Combination Area since 1990 have come primarily in the form of temporary activity that has had potential to disrupt goshawk breeding cycles in some areas. These include road maintenance projects, trail construction and maintenance, mining operations, dispersed recreation events, military exercises, utility corridor maintenance, grazing allotment activity, recreational mining, and mine closures and clean-up. A few enterprises, such as commercial mining operations and establishment of access roads to private inholdings, have resulted in more permanent human presence. But in all cases, the potential for disturbance of local goshawks has been taken into consideration and mitigated.

The maintenance of numerous centers of long-term human activity continue to influence the areas where goshawks choose to establish nesting sites and PFAs. While some goshawk pairs will establish nests relatively close to certain human developments with predictable activity (Forest roads, trails, cabins, campgrounds), most choose to avoid areas that might lead to humans approaching nests or entering active PFAs. This eliminates some of the forest stands that might otherwise be suitable as nesting and PFA habitat. Ongoing establishments that can have this effect include 3 campgrounds, 2 day use areas, a rental cabin, 5 trailheads, 12 recreational residences, electronic sites, a target range, some mine sites, and a number of roads to private inholdings with residences.

The only ongoing HNF vegetation project in the Combination Area is the Clancy-Unionville Hazardous Fuels Reduction Project. Removal of dead trees from private lands continues, as does firewood cutting along roads by the general public. These activities have some potential to influence goshawk habitat

use by generating local disturbance and by removing dead trees that may be of some use to goshawks and thus altering foraging patterns. None, however, is reducing viable nesting habitat.

The primary reasonably foreseeable action with substantial implications for goshawks in the Combination Area is the Telegraph Vegetation Project, which would remove dead trees and thin young conifer stands on >6,000 acres just west of the Continental Divide. This would have much the same effect as Alternative 2 in the current project, but on a considerably larger scale.

The no-action would not add to past, ongoing, or reasonably foreseeable cumulative effects. The primary impact on goshawk habitat would thus continue to come from the Mountain Pine beetle outbreak, which has reduced potential goshawk nesting habitat from around 54% to roughly 18% of the Combination Area. It has also opened up much of the previous closed forest foraging habitat. These conditions, while far from optimal, should allow a viable local population of goshawks to remain in the area.

The 490 acres of dead trees remove by the proposal would not be enough to measurably alter the pattern of potential goshawk nesting, PFA, and foraging habitat in the Combination Area. As with the no-action, the primary forces that have shaped current goshawk habitat availability in the cumulative effects area are past timber harvest and the mountain pine beetle outbreak.

Forest Plan Consistency

The goshawk is covered in the *Helena Forest Plan* as a management indicator species for old-growth forest [*HFP* Indicator Species standard, p. II/17]. The standard requires that goshawk populations "be monitored to measure the effect of management activities on representative wildlife habitats [in this case, old-growth] with the objective of ensuring that viable populations of existing native and desirable non-native plant and animal species are maintained." Specific monitoring requirements are laid out in Chapter IV, Resource Element C7 (*HNF,* p. IV/8). This element focuses on monitoring 20% of specified old-growth sample units for goshawks. There is, however, a disconnect between sampling old-growth and sampling for goshawks in that most goshawk nest sites are located in forest stands other than old-growth—and simply sampling old-growth stands is an inefficient way to monitor goshawks. Old-growth is sampled each year with a view to finding goshawks, but known goshawk nests are monitored each year regardless of the forest formation where they are found, and new areas are sampled in the hope of finding new nests.

The goshawk nests in the project area have been monitored since the discovery of the active nest in 2012. Neither the 2012 nor the 2013 nest are located in old-growth stand. There is no old-growth forest in the proposed treatment units. The project would not alter known goshawk nest sites, past or present. The city of Helena fuels treatment project along the western part of the flume—an action connected to the HNF project—came close to the 2012 goshawk nest, but left the site intact. These birds remain in the area, having established a new nest some ¼ mile from the 2012 site. The HNF proposal is consistent with the *Forest Plan* standard for goshawks and old-growth monitoring.

Sensitive Plants

Forest Service policy requires that a review of programs and activities, through an effects analysis, be conducted to determine their potential effect on threatened and endangered species, species proposed for listing and Regional Forester designated sensitive species. The purpose of this document is to present the analysis and determination of effects of the actions Forest Service sensitive species (FSM 2670.31-2670.32).

For threatened and endangered species and species proposed for listing, the analysis and document are referred to as a Biological Assessment, or BA. No plants federally listed or proposed by the U.S. Fish and Wildlife Service are known or suspected to occur on the Helena National Forest, therefore there will be no further discussion of federally listed or proposed plants in this document.

For sensitive species the analysis and document are referred to as a Biological Evaluation or BE (FSM 2670.3). Preparation of a Biological Evaluation as part of the NEPA process ensures that sensitive species receive full consideration in the decision-making process.

The Helena National Forest has known or suspected occurrences of twenty-one species of sensitive plants. A complete list of these species and a description of associated habitat can be found in the following table. The likelihood of occurrence of a given species within the project area and status is listed below.

The species listed as "known" (indicated in bold) occur in the project area. The species listed as "possible" (also indicated in bold) in the following table are those species whose habitat is potentially included in the project area. The remaining species do not have habitat that would be directly impacted by these activities, due to the type of habitat in which the plants occur.

Table 41: Helena National Forest Sensitive Plant Species

Species	Known Occurrences Helena National Forest	Known from Flume Chessman Analysis Area	Likelihood of Occurrence in Project Area
*Amerorchis rotundifolia (*Orchidaceae)	No	No	Unlikely – known from the Rocky Mtn. Front and NW corner of state, in spruce forests along seeps/streams
Aquilegia brevistyla (Ranuncula-ceae)	No	No	Unlikely – in Montana, known only from Little Belt Mtns.; open woods and stream banks at mid-elevations in montane zone.
Astragalus lackschewitzii (Fabaceae)	No	No	Unlikely – restricted to high elevation gravelly and rocky slopes and ridges; habitats not generally subject to human disturbance
Botrychium crenulatum (Ophioglossa-ceae)	No	No	**Possible** – known from the Beaverhead Deerlodge and in western Montana, generally in wet habitats with high cover.
Botrychium paradoxum	Yes	No	**Possible** – Known from the Occidental Plateau, and

Species	Known Occurrences Helena National Forest	Known from Flume Chessman Analysis Area	Likelihood of Occurrence in Project Area
(Ophioglossa-ceae)			near Irish Mine Hill; habitat of Helena NF populations are in sagebrush/rough fescue and rough fescue,.however other populations have been documented from mesic meadows associated with spruce and lodgepole pine forests in montane and subalpine (MTNHP 2010).
Cypripedium parviflorum (Orchidaceae)	No*	No	Unlikely – Habitat in fens, damp mossy woods, seepage area, and moist forest-meadow ecotone, valley & lower montane.
Cypripedium passerinum (Orchidaceae)	No	No	Unlikely– in mossy, moist, or seepy places in coniferous forest; northwestern Montana including Glacier NP.
Drosera anglica (Droseraceae)	Yes	No	Unlikely – Known from Indian Meadows, occurs with sphagnum moss in wet, organic soils of fens.
Drosera linearis (Droseraceae)	Yes	No	Unlikely – Known from Indian Meadows, in wet, organic soil of nutrient-poor fens.
Epipactis gigantea (Orchidaceae)	No	No	Unlikely – associated with seeps/springs, often thermal.
Goodyera repens (Orchidaceae)	No	No	Unlikely – in Montana, known from Little Belt and Big Snowy Mtns.; in moist, montane forests with mossy understory.
Grindelia howellii (Asteraceae)	No	No	Unlikely – endemic known only from a cluster of sites northeast of Missoula, and a single county in Idaho.
Juncus hallii (Juncaceae)	Yes	Yes	**Known**—several populations occur on the Forest in the Big Belts and the Divide area. Moist to wet meadows.
Oxytropis podocarpa (Fabaceae)	No	No	Unlkely – habitat in alpine zone.
Phlox kelseyi var. *missoulensis* (Polemoniaceae)	Yes	No	Unlikely--Known from each of the four landscape areas across the forest; habitat is rough fescue meadow, exposed, limestone-derived slopes in foothills and montane.
Pinus albicaulis (Pinaceae)	Yes	Yes	**Known—**known from each of the four landscape areas, including the project area. Habitat is high elevation forested scree.
Polygonum douglasii ssp. *austinae* (Polygonaceae)	Yes	No	Unlikely – Known only from the Big Belts landscape in open gravelly shale-derived soil of eroding slopes/banks or usually moist barren shale slopes,
Saxifraga tempestiva (Saxifragaceae)	No	No	Unlikely – Montana endemic known only from vernally moist open sites and rock ledges at high elevations, west of Continental Divide.
Schoenoplectus subterminalis	Yes	No	Unlikely – Known from Indian Meadows, and sites in

Species	Known Occurrences Helena National Forest	Known from Flume Chessman Analysis Area	Likelihood of Occurrence in Project Area
			NW primarily west of Continental Divide; open water and boggy margins of ponds, lakes, and sloughs.
Thalictrum alpinum (Ranunculaceae)	No	No	Unlikely – in Montana, known from sites in SW corner, in moist alkaline meadows.
Veratrum californicum (Liliaceae)	No	No	Unlikely – in Montana, from 4 sites in Bitterroot Valley

Sensitive plant surveys will be conducted for the project units prior to project implementation. Surveys will take place at the appropriate time of year when phenology is appropriate for identification. These surveys would be necessary in units occupied by the following habitats: open/wet meadows, moist forb/grass meadows, and coniferous wet meadows/ecotones.

General surveys will occur in all units. In units where sensitive plants are found, more focused and systematic surveys will be conducted. Detailed maps showing the exact route that the botanists travelled on the ground will be on file at the Helena National Forest. Plant Survey Field Forms and MNHP Plant Observation/Species of Concern Survey Forms completed will also located in the project file.

Effects Common to both No-Action and Proposal

Mountain pine beetle infestations have compromised the lodgepole pine component of forested vegetation in the project area. Over time, the dead lodgepole will fall and create a heavy fuel loads adjacent to the flume and reservoir. As a result, the potential for fire to occur in the project area exists whether or not this project is implemented. Implementing the treatments as proposed would reduce fire behavior and intensities within the treatment area.

The potential exists for wildfire to have a short-term detrimental effect on sensitive plant habitats, but no long-term effects in most cases. Plant response to fire is a result of the interaction between severity of the fire and the individual plant species' inherent resistance to injury and ability to recover (Brown et al. 2000). Mortality of herbaceous species is more dependent on the length of time plants are exposed to high heat, determined by the amount of duff and woody fuel consumed by the fire, than flame length and fire line intensity (Armour et al. 1984). The effect of wildfire on sensitive plant habitats therefore would depend on the surface fuel conditions and the size of the wildfire. The longer fuels build up on the forest floor, the greater the potential damage to sensitive plant habitats. Pinus albicaulis ecosystems were maintained through fire and insect regimes, and regenerate best in open, sunny conditions (Tomback et al 2001).

The spread of noxious weeds can have an adverse impact on sensitive plant populations under any alternative. Noxious weeds dominate plant communities tend to form monocultures which negatively impact native biological diversity. This weed competition to individual plants and plant communities can result in loss of species diversity and sensitive native plants or habitat. If noxious weeds are left

unchecked, they can out-compete sensitive plant populations, especially those close to motorized routes in drier habitats. Herbicides have the potential to adversely affect sensitive plant habitats under any alternative. Any herbicide treatments that occur in the project area have been analyzed in the Helena National Forest Weed Treatment Environmental Impact Statement. The environmental protection measures will be applied accordingly (USDA 2006).

Cumulatively, the past projects that have occurred since 1993 that are currently completed have all had ground reconnaissance to determine whether sensitive plant populations would be impacted by the respective project. Where sensitive plant populations were found, populations were appropriately buffered from treatment. There are only minimal effects to sensitive plant habitats resulting from ongoing activities with a low probability of impacting individuals. Under the proposed action, the cumulative effects would likely be minimal as identified resource protection measures will be applied to known *Pinus albicaulis* and *Juncus hallii* populations within the project area. Surveys are currently occurring or have been completed for future foreseeable actions. If populations have been/are found, they will be protected from ground disturbance or herbicide application. For a more detailed discussion of cumulative effects, please refer to the Sensitive Plants specialist report, located in the project record.

No-Action

No effects would occur to sensitive plants under the current trend except the effects noted under "Effects Common to both Current Trend and Proposal" section of this document. Sensitive plants will remain undisturbed except in the case of wildfire. An exception to this trend is that of Whitebark pine where the current trend is a continuing loss of viability due to fire suppression, change in climate, mountain pine beetle, and white pine blister rust (USDI 2011).

Proposal

The proposal would involve ground disturbance from tree removal equipment and temporary road construction which has the potential to affect sensitive plant populations. With the design criteria resource protection measures, the alternative may impact individuals but would not contribute toward a trend for federal listing or loss of viability.

Prescribed fire and pile burning after tree removal are proposed to reduce surface fuels. The use of prescribed fire would be expected to stimulate the growth of native understory vegetation over the long-term (Armour et al. 1984). Prescribed fire treatments are likely to increase the overall understory native species richness (Dodson et al. 2008; McGlone et al. 2009) and percent cover, although non-native species may also be promoted if allowed to spread into treated areas (McGlone et al. 2009). No whitebark pine would be cut, and would be protected to the extent feasible during implementation.

The potential for additional infestations of noxious weeds would likely be higher in treatment areas. If any sensitive plant populations do occur in the treatment area, noxious weeds would adversely affect populations. In addition, herbicide use would also adversely affect sensitive plant populations. Any herbicide treatments that occur in the project area have been analyzed in the Helena National Forest Weed Treatment Environmental Impact Statement. The environmental protection measures will be applied accordingly (USDA 2006).

Juncus hallii and *Pinus albicaulis* and the associated habitats are known to occur in the project area. No additional sensitive plant populations have been found to date in the analysis area. Habitat with potential to support *Botrychium paradoxum* and *Botrychium crenulatum* exists in the project area and surveys are currently occurring or have been completed to determine if they are present. If any other species are found, they would be protected from ground disturbance or herbicide application as appropriate. As directed by the Forest Plan, if any of the species of special concern are verified, appropriate measures pursuant to Section 7 of the ESA would be applied.

SPECIES- Juncus hallii
Determination: The decision may impact individuals but would not contribute toward a trend for federal listing or loss of viability. The species is known from the analysis area, but design features as described in proposal would protect individuals and potential habitat.

SPECIES- Pinus albicaulis
Determination: The decision may impact individuals but would not contribute toward a trend for federal listing or loss of viability. The species is known from the analysis area, but design features as described in the proposal and Forested Vegetation Specialist Report would protect individuals and potential habitat.

Forest Plan Consistency

The Forest Plan direction for sensitive plants (USDA 1986, II/20) refers to the Endangered Species Act and pertains only to listed species, none of which occur on the Helena National Forest. Therefore, this direction is not applicable at this time. Subsequent guidance from the Regional Office provides direction regarding sensitive plants and their habitats with which the project as proposed is consistent.

Heritage Resources

The National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations in 36 CFR 800, provide the legal framework for considering cultural resources in project planning. NHPA Section 106 requires that federal agencies take into account, in consultation with the State Historic Preservation Officer (SHPO), Tribal Council, and the Advisory Council on Historic Preservation (ACHP), the potential effects of agency actions on places and sites of archaeological or historical significance. The act establishes the National Register of Historic Places, a listing of locally, regionally and nationally significant heritage properties (36 CFR 60). In project planning, agency historic preservation specialists use the National Register eligibility criteria to determine the scientific, historical or cultural value of cultural resources affected by project actions. The term “historic” in this context refers to cultural properties that are the result of prehistoric use (prior to Euro-American influence) or historic period use. They may represent a single event or a complex system. They may be an object, feature, site or district. The consideration of effects previewed in NEPA is formalized through the NHPA Section 106 review process. Section 106 review is the subject of Regional Programmatic Agreements (PA), as well as federal policy and guidance.

The Archaeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act, Executive Order 11593 (Protection and Enhancement of the Cultural Environment),

and Executive Order 13007 (Indian Sacred Sites) also require federal agencies to identify, monitor, protect, and preserve cultural resources under their jurisdictions.

Federal Agencies carry out their responsibilities under heritage laws and regulations by conducting documentary research, consulting with Tribal Councils, the State Historic Preservation Offices (SHPO), the Advisory Council on Historic Preservation (ACHP), and others, and often by field surveying to identify cultural properties. Disclosure of potential effects is initiated with the NEPA analysis, and finalized through compliance with NHPA Section 106 for the selected alternative. Site specific effects analysis and the resolution of effects are ensured by following the regulatory review process of 36 CFR 800. This process is further guided by the Region One Forest Service Programmatic Agreement and certain Federal and Regional Forest Service policies. These documents include the Region One Policy for integrating NEPA and NHPA (1991), the Region One Programmatic Agreement for Cultural Resources (USDA Forest Service et. al. 1995) and the East Side Forest Site Identification Strategy (1995). Through the Section 106 process, all undertakings are identified and addressed, and any necessary mitigation measures incorporated into the project design, the final EA, or other appropriate heritage resources agreement. The goal is to avoid, minimize, or mitigate impacts to significant heritage properties.

Both NHPA and ARPA contain provisions for the confidentiality of certain cultural resource information. Site specific locations and other sensitive site data are not disclosed to the public. Documents containing this information are filed separately in the project planning record and are marked with an asterisk (*); this information is exempt from public disclosure and not available under the Freedom of Information Act.

Cultural resource information is incomplete for the Flume Chessman Reservoir project analysis. The project area has not been completely surveyed for cultural resources. However, for purpose of this NEPA analysis, it is assumed that existing HNF heritage program data collected from 1979 to 2012 is sufficient to analyze cultural resource density, distribution patterns, and the general range of project effects.

Background

A total of 8 cultural sites are located within the Flume Chessman Reservoir project boundary. With only three sites (24LC1559, 24LC0876, and CU-08-01) located within treatment units. The main site of concern is the Chessman Reservoir, Dam and Red Mountain Flume (24LC0876). Site 24LC0876 will be discussed in detail.

The Chessman Reservoir is an historic municipal water supply source consisting of three principle features: a main earthfill dam, a smaller saddle dam or spillway, and the Red Mountain Flume. The main dam and flume are on the west shoreline of the reservoir, while the saddle dam is astride the divide at the northeast corner of the reservoir.

Like most earthfill dams, Chessman Reservoir/Dam was located near a divide so that a spillway could be built apart from the main dam. It was advantageous to separate the spillway from the main dam in order to protect the main dam from the erosive effect of overflow. Hence the site of the reservoir was chosen not for its ability to collect water (the watershed was small and had to be supplemented by a flume), but for its ease of storing water.

Chessman Dam had a tragic precedent. On August 8, 1876, an earlier dam in the same small basin gave way, sending a torrent down Tenmile Creek that swept away two men in one cabin and one woman in another. The flood reached all the way to Kessler's Brewery and Colonel C. A. Broadwater's Hot Springs Hotel. The Helena Water Works Company obtained a use permit for the dam and reservoir from the Helena National Forest in January 1907. Eugene Carroll, chief engineer of the Butte Water Company was employed to develop plans for a new impoundment reservoir. The most noticeable change in the plans was the installation of a concrete core wall in the center of the main earth dam. The main safety feature of the new reservoir was a spillway at the northeast corner of the reservoir. This spillway, or saddle dam, was situated on the divide between the Beaver Creek and Buffalo Creek watersheds. The current Chessman Reservoir was completed in 1908 by the Helena Water Works Company and acquired by the city of Helena in 1912. This acquisition included all the principle features in the Tenmile watershed. The reservoir served as the only water source for Helena for over three decades.

The historic site (24LC0876) appears eligible for nomination to the National Register of Historic Places under Criteria A (SHPO 1988-24LC0876 site file). The construction of Chessman dam, reservoir and flume represents a significant period in the development of the city of Helena.

Background research identified two additional historic sites inside proposed treatment units. Site 24LC1559 is a historic placer ditch which was never completed. The upper end of the ditch has been truncated by road construction and the lower end terminates on sloping ground 400-450 feet to the north. Because the ditch does not lead to a placer pit and ends on unpatented land, one infers that the features was neither completed nor used. Site 24LC1559 is not National Register eligible because it lacks significance and integrity (Rossillon 1999-24LC1559 site file). Lacking written historical information about the site, it is virtually impossible to date the ditch or too associate it with a specific person. The last site located within a treatment unit is the site CU-08-01, which is a mine sites consisting of eight prospect pits and their associated waste rock piles. This site was never assigned a Smithsonian number during its discovery for the Clancy/Unionville Vegetation Project in 2001. A full recording of the site will need to be done before an eligibility determination can be made, therefore it will be treated as eligible in this analysis.

Like much of the HNF, the project area was extensively prospected and mined from the 1860s to the 1940s. The area of potential effect has not been survey, but most likely the APE is covered with scattered prospect pits and trenches, ditches, adits, and related industrial features. In some cases, these features are sufficiently "hardened" and the treatments proposed for Flume Chessman project would have little adverse effect and require minimal or no mitigation work. For example, running prescribed fire atop scattered prospect pits (dirt piles) or water ditches, and hand-treating fuels in the area, would not cause an adverse effect. The only caution is those ruins that contain wood components that are fragile or flammable, such as the Red Mountain Flume (24LC0876).

No Action

Cultural resources would continue to be vulnerable to fuel loading, increasing the risk of wildfire. Un-controlled wildfire has the potential to negatively affect cultural resources such as the Red Mountain Flume and other wooden structures in the project area. In addition, wildfires cause erosion through

vegetation loss resulting in resource damage through artifact displacement. Vegetation loss may also inadvertently lead to increases in vandalism and looting of cultural resources due to increased site access and exposure.

If the no action was selected then at this time, cultural resources within the project area would not be evaluated for the National Register of Historic Places, nominated to the register (if eligible) and managed in such a way as to prevent adverse effects.

Proposal

The direct effects from the Red Mountain Flume Chessman Reservoir project may include increased site access and exposure to the elements, which could result in a greater chance of looting and artifact displacement. The proposed treatments would cause temporary loss of vegetation cover, which has the potential to cause erosion, increasing artifact displacement and collecting, if artifacts are exposed. Mechanical harvest requires timber felling, hauling, dragging, and lifting of downed logs to landing and/or decking areas. These activities churn-up soil and thus cause ground-disturbance that could affect archaeological sites and historic ruins located atop or buried within the forest duff and soil matrix.

Hand treatments (lop and scatter fuels) has similar ground disturbance to over frozen ground logging, and less likely to affect cultural sites than prescribed burning. Still, a minor amount of soil disturbance often occurs in areas where the resulting slash is piled and burned. Prescribed burning to reduce fuels loading and remove encroaching vegetation has an obvious adverse effect to any cultural resource composed of wood or other flammable material. Construction of containment line may also cause minor ground disturbance.

The construction and reclamation of temporary access roads and log decks can cause ground disturbance that adversely affects cultural resources. In all cases, effects to prehistoric and historic sites can be avoided during project redesign and follow up through implementation.

Since the focus of this project is to safeguard the Helena Water Supply system, the proposed treatments will be a benefit to the historic site of Chessman Reservoir and Red Mountain Flume (24LC0876). For newly discovered cultural resources, treatment units may need to be modified to avoid adversely affecting these cultural resources unless deemed National Register-ineligible (not significant), in accordance with 36 CFR part 60. Consultation with the Montana State Historic Preservation Office and Tribal Councils would be required.

Prehistoric and historic properties are a non-renewable resource. They represent a resource base that cannot be replenished. In this sense, all effects are cumulative and work to reduce the archaeological/historic record. Road construction and use, mining activities, historic timber harvest, fires and suppression, grazing and range developments, and other developments or reclamation have the potential to directly affect cultural resources by reducing the quality and/or quantity of sites due to disturbances or obliteration.

This alternative has the potential to improve cultural resource protection in the Red Mountain Flume Chessman Reservoir project area, especially the Chessman Reservoir, Dam and Flume (24LC0876) site. If

the action alternative was selected then cultural resources within the project area could be evaluated for the National Register of Historic Places, nominated to the register (if eligible) and managed in such a way as to prevent adverse effects.

The Helena National Forest is in the process of issuing a new Special Use Permit to the city of Helena for the Chessman Reservoir, Dam and Flume and a right of way of 100' on each side of the flume on which to operate and maintain the system on the Helena National Forest. Routine activities under this permit may include, but are not limited to, proactive repairs of facilities, treatment/removal of trees and shrubs within the right of way and around the dam/reservoir. The Chessman Dam and Red Mountain Flume (24LC0876) is eligible for listing on the National Register of Historic Places, therefore all maintenance activities would need to meet Historic Preservation Standards to maintain site integrity. Historic Preservation Standards would be included in the Special Use Permits Operation and Maintenance Plan and agreed upon by the city of Helena and Helena National Forest, resulting in no adverse effect to the cultural site 24LC0876.

Forest Plan Consistency

The Forest Plan requires the integration of cultural resources in project planning and forest management. Compliance inventory, evaluation of site significance and project effect, consultation with the Montana State Historic Preservation Office and Tribal Historic Preservation Officers, and implementation of design features for project-affected cultural resources would comply with the National Historic Preservation Act and its implementing regulations in 36 CFR 800, as well as Helena National Forest Plan (USDA 1986) standards and guidelines. Therefore, the results of the Flume Chessman project on cultural resources would remain within Forest Plan standards because NHPA Section 106 would be completed prior to implementation and mitigation would be done to avoid adversely effecting cultural resources within the planning area.

Proposed activities that have the potential for ground disturbance will require field inventory for cultural resources to comply with NHPA Section 106, NEPA and Forest Plan Standards. If inventories cannot be completed prior to signing a decision, than a phase approach under the Heritage Programmatic Agreement (PA) with the Montana State Historic Preservation Office (MT SHPO) would require consultation prior to approval. The Forest heritage resource personnel anticipate being able to complete NHPA Section 106 inventories prior to signing a decision, therefor achieving Section 106 compliance through channels outlined in the PA.

No ground disturbance would occur until NHPA Section 106 compliance is finalized. The potential adverse effects of these activities would be mitigated through the implementation of mitigation-protection measures, resulting in a no adverse effect finding. Final cultural resource protection measures would be established, if needed, after the completion of Section 106 inventories.

The proposal would have the most beneficial effect to cultural resources because vegetation treatments proposed would limit the effects from natural events such as fuel loading and trees falling which has the potential to damage cultural sites. The proposal gives the Helena National Forest an opportunity to

manage and mitigate adverse effects to known cultural sites within the project area, as well as maintain integrity of sites which are eligible for listing on the National Register of Historic Places.

Fisheries

There are no fish-bearing streams or habitat within the project area itself (see map, Appendix A). Fishery surveys in the Upper Tenmile Creek and Lump Gulch drainages by USFS and MDFWP fisheries crews over the past 20 years documented no sensitive westslope cutthroat trout populations present, and both watersheds are outside the range of listed bull trout or critical habitat under the Endangered Species Act of 1973.

The western pearlshell mussel indigenous to western Montana was recently added to the Region 1 sensitive aquatic species list in June, 2011. This species is therefore also considered in this report. Statewide surveys by Stagliano (2010) found no evidence of this species occurring in the lower reaches of Tenmile Creek and Lump Gulch where potentially suitable habitat and salmonid fish occur needed to support this species.

This project area is outside the range of fish populations present in both the Tenmile Creek and Lump Gulch sub-watersheds. However, due to fisheries downstream from this proposal supports the need to evaluate potential effects to those fisheries. Therefore, the common denominator of various ongoing activities impacting fisheries (stream) habitat is excess fine sediment beyond background natural levels (Meehan 1991, pgs 5-6). Although the effects of all ongoing activities cannot be precisely measured, it is commonly accepted in watershed practice that the streambed is the ultimate integrator of land-use activities including natural background processes occurring upstream of a response reach. Fittingly, the cumulative effects of the ongoing activities in a watershed are best measured in the streambed of critical (response) reaches with the focus on percent fine sediment levels in spawning substrates. Critical reaches are those that reflect changes in salmonid spawning habitat as a function of altered sediment yield from a specific area (project area) of interest (Stowell et al. 1983).

Core sampling data from a multitude of streams in the Lake Helena Watershed Planning Area found 2/3rds of the overall range to be about 9.9% each side of the mean (USEPA 2004, pgs 225-231). Therefore an average of 30% fines in spawning habitats with ± 9.9% variation is assumed to represent a plausible mean reference value and reasonable measure of natural variation for fisheries management goals.

Helena National Forest fish biologists have sampled fine sediments in response reaches for Tenmile Creek below Banner Creek and in Lump Gulch below Corral Gulch using McNeil substrate core sampling methodologies as described by Platts et al (1983, pgs 17-20). Percent fine sediments (<0.25 in. dia.) in the response reach of Tenmile Creek average around 34.5%. In Lump Gulch, average fine sediment levels are much higher and variable at 39.9%. Both figures represent baseline conditions (fine sediments by depth) for fish habitat in each stream as a function of ongoing activities and background sediment.

No-Action

The 34.5% percent fine sediment levels in the response reach of Tenmile Creek indicates moderately elevated conditions of fine sediment for salmonid spawning habitat compared to reference conditions (30%). This level remains within the accepted range of variation for fish habitat management goals. Ongoing activities over the past couple decades in Tenmile Creek have changed little with the exception of abandoned mine reclamation projects on federal and non-federal lands within the drainage. It has long been recognized that the principle source of chronic fine sediment in drainages is from the existing transportation network (Brooks et al. 1991, pgs 184-185; Waters 1995, pg 24). Brooks et al. (1991) point to various studies that indicate as much as 90% of the sediment generated from forest management originates from roads. Based on road surveys by hydrology staff, road 299 (Beaver Creek road) in the project area contributes about 5.3 tons of excess sediment annually into Beaver Creek and eventually fish habitat in Tenmile Creek. With no imminent changes in this activity, it is unlikely there will be an upward or downward trend in percent fine sediments in Tenmile Creek below Rimini.

In the fish-occupied segment of Lump Gulch below Corral Gulch, average percent fine sediment levels are almost 40%, which is considered a relatively high departure from the 30%. Ongoing activities over the past couple decades in this sub-watershed are expected to continue with the transportation network being the principle source of chronic fine sediment. Findings from road surveys conducted by Helena NF hydrology staff indicate that the Corral Gulch segment of road 4009 contributes approximately 4.9 tons of sediment annually into Corral Gulch and eventually fish habitat in Lump Gulch.

Cumulatively, the past and ongoing projects are represented in the current 34.5% Tenmile level and 39.9% in Lump Gulch and further defined in the cumulative effect table in the Fisheries specialist report. These current level of percent sediment fines are higher compared to reference (unmanaged) conditions but less than the 40% considered as an upper range acceptable for fish habitat management goals. Reasonably foreseeable activities point towards static conditions in the short-term with a general long-term trend of reduced sediment loading in Tenmile Creek primarily due to the Tenmile Road Improvement Project, which paves about six miles of dirt road in the valley bottom below Rimini.

The continuation of the current trends would comply with federal and state laws and regulations as they relate to aquatic resources (fish and other aquatic life forms) because no activities would occur in the project area that would be a risk to the current fish populations and habitat conditions occurring downstream in Tenmile Creek and Lump Gulch.

An existing permit for the city of Helena to maintain the flume infrastructure in the foreseeable future is assumed to remain unchanged with the current 15-foot right-of-way (7.5 feet either side of the centerline of the flume). The current permit does not present a sediment risk to downstream fisheries in Tenmile Creek below Rimini.

Proposal

There would be no direct effects on salmonid fish habitat as a function of tree cutting and fire treatments in Upper Tenmile Creek and log hauling over road 299 (Beaver Creek road) and 4009 (Corral

Gulch road). This is because there are no fish populations or fish habitats present in or nearby the project area that could be directly impacted by actions tied to the project.

There would be potential for indirect effects, however, on salmonid habitat located downstream from the project in mainstream Tenmile Creek and Lump Gulch because tree cutting and fire treatment activities in the project area in conjunction with log hauling raise the risk of generating sediment delivery into nearby fishless channels connecting to fishbearing streams.

A combined set of resource protection measures for soils, water, and fisheries has been incorporated into the project design resulting in sediment modeling showing no risk for sediment accessing nearby streams or Chessman Reservoir. These results are primarily due to 100-foot no ignition buffers, 50-foot set-back buffers for pile burning, and application of forestry BMPs. Chessman Reservoir furthermore provides effective sediment trap to treatment units 10, 11, 12, 13, 14 and 15 should sediment incidental to these units reach the reservoir. Treatment unit 8 surrounding the flume is the only unit where a skid trail would bisect a natural channel. Therefore a temporary crossing structure in conjunction with no skidding within 50-feet of the channel is planned that would mimic the resource protection measures preventing incidental sediment delivery from skidding. Implementation of all resource protection measures would result in no sediment deposition downstream into fish-bearing Tenmile Creek from activities associated with the treatment units.

The role of log truck traffic for increasing road sediment production is well studied and a concern for water quality and fish habitat. About 327 truckloads of logs would travel over road 299 in Upper Tenmile Creek and about 734 truckloads (includes the 327 loads over road 299) would occur over road 4009 in Corral Gulch, a tributary to fish-bearing Lump Gulch. Due to water quality concerns and increased potential for indirect fine sediment deposition to Tenmile Creek Lump Gulch and from log haul traffic, surveyed road sediment delivery points were modeled using the WEPP roads module to determine existing sediment loading and potential decreases from road improvements (see hydrologist report). The model results show about a 90% reduction in existing annual road sediment delivery by implementing improvements to roads 299 and 4009 as specified in the hydrologist report. The ford crossing on road 299-H1 would be hardened and its approaches surfaced appropriately to guard against increased sedimentation from 4-6 truckloads crossing this ford. Current research indicates surfacing with a minimum 6 inches of quality aggregate can reduce production of sediment by 90-97 percent compared to unsurfaced roads (Burroughs and King 1989). Therefore, haul route improvements implemented prior to initiating treatment activities in the project area would negate accelerated sediment delivery rates caused by log haul traffic and result in no increased fine sediment deposition over existing levels in Tenmile Creek and Lump Gulch. With proper maintenance of these road improvements, it is conceivable for road sediment delivery to streams to decrease from their current levels.

The half mile of temporary road needed to access unit 15 near the Tenmile sub-watershed divide is confined to upland terrain with no intermittent or perennial connection to the stream system. When taking into consideration all resource protection measures for soils, water, and fisheries applied to treatment units and road improvement treatments, the proposal would have no indirect effect in the

form of added sediment deposition over current levels in salmonid fish habitat downstream in Tenmile Creek or Lump Gulch. With road maintenance to preserve drainage improvements on roads 299 and 4009, there would likely be some reduction of sediment deposition from current levels in Tenmile Creek and Lump Gulch although unlikely detectable due to the variability in sediment levels for both streams.

The past and ongoing projects are the same as the discussion under the current trends above. Reasonably foreseeable activities point towards static conditions in the short-term. In the long-term, there should be a slight downward trend in sediment loading to Tenmile Creek primarily as a function of the Tenmile Road Improvement Project. Reductions in sediment loading would be minimal because most of Tenmile Creek has an adequate vegetation buffer between the road and stream that already prevents most road sediment from accessing Tenmile Creek

Re-issuance of an existing permit for the city of Helena to maintain the flume infrastructure in the foreseeable future would expand the existing 15-foot right-of-way (7.5 feet either side of the centerline) of the flume to 200 feet (100 feet both sides of the flume). This corridor ongoing maintenance would be limited under the new permit to hand-only treatments with no mechanical ground-based equipment used. Carrying the resource protection measures for soils, water, and fisheries over into the re-issued permit would ensure no sediment risk to the surface water system that could convey fine sediments downstream into Tenmile Creek.

Since the proposal's activities and haul routes occur in Upper Tenmile Creek and Lump Gulch 6th-HUCs they are outside the range of bull trout on the Helena National Forest, a species listed as threatened under the Endangered Species Act. As such there would be no effects on bull trout or bull trout critical habitat. The two sub-watersheds under consideration for potential effects from treatment units and heavy log truck traffic also do not support any populations of sensitive westslope cutthroat trout or occurrences of western pearlshell mussel. Hence, past, present and foreseeable activities plus activities under the proposal would have no impact on sensitive aquatic species.

There are no fish-bearing streams or habitat within or near the project area itself; therefore, there would be no direct effect on fish habitat from project activities. However, there would be some risk for indirect effects to salmonid fish habitat occurring downstream of the project area units and haul routes (roads 299 and 4009). Non-native brook trout and rainbow trout occur downstream in main stem Tenmile Creek below Rimini and brook trout occur downstream in main stem Lump Gulch. Therefore, the risk would be from fine sediment generated from project activities that may accrue further downstream outside the project area in response reaches of Tenmile Creek and Lump Gulch.

This proposal would comply with federal and state laws and regulations as they relate to aquatic resources (fish and other aquatic life forms) because the following primary design elements would minimize erosion and prevent potential sediment transport to surface water bodies:

- 100-foot no ignition buffers are applied to all treatment units in the project area.
- 50-foot setbacks from any stream channel are applied to pile burning.
- A ford on Beaver Creek used for transporting harvest products would be hardened to minimize sedimentation to Beaver Creek and stabilize the crossing.

- Temporary roads are minimized to less than 0.5 mile and restricted to upland terrain with no intermittent or perennial connection to the stream system.
- All log-haul roads with surveyed sediment delivery points would be improved and maintained to minimize or eliminate road sediment delivery prior to initiating treatment activities.

In addition to the above elements the combined soil, water, and fish resource protection measures would provide a full suite of water quality safeguards to prevent excess sediment from accruing downstream into Tenmile Creek and Lump Gulch. This proposal when combined with reasonably foreseeable future actions would not risk an upward (negative) trend from these baseline conditions in fish habitat. Commitment to road maintenance to preserve drainage improvements on roads 299 and 4009 would likely bring about a reduction in sediment deposition from current levels in Tenmile Creek and Lump Gulch.

Forest Plan Consistency

Tenmile Creek (from treatment activities & log hauling) and Lump Gulch (from log-hauling over road 4009) have potential to be affected by a decision upstream within these two 6th-HUC watersheds. Consistency would be accomplished due to ongoing road improvements in Tenmile Creek; road improvements/BMPs applied to log haul routes (roads 299 and 4009) for project; and resource protection measures relevant to soils, water, and fish.

Recreation & Inventoried Roadless Characteristics/Wilderness Attributes

No-Action

Recreation will continue on a plan trend trajectory (business as usual). Dispersed recreation will continue to occur at sites that appeal to users. Travel to developed recreation sites adjacent to the project boundary will continue to be accessed unaffected by vehicles hauling logs and equipment to and from the Helena National Forest. The user created trails will continue to lead hikers to the top of Red Mountain and along the flume itself. Hunting will continue to be popular in the flat terrain around the reservoir.

As more trees die and blow down, gaps in the canopy will open, creating more exposure. Tree blow downs could block portions of the trails and complicate other recreation activities. The quality of hunting will evolve as vegetative cover changes. Heavy fuel accumulations could lead to a wildfire, which might change the recreational setting. Natural processes will continue to shape the landscape and the user created recreation will adapt to on-the-ground conditions.

Various prior vegetation treatments, such as timber harvests, fuel reduction efforts, roadside hazard tree removals, and firewood cuttings are evident in varying degrees on the landscape and collectively shape the recreational setting. Due to the dispersed nature of recreation in the project area, its form being created by the recreational user's response to site conditions, it is highly adaptable.

Proposal

The dispersed recreation camping sites along the haul routes would likely be less desirable to users. Some dispersed camping could be displaced due to area closures or related operation activities. Users of adjacent developed recreation sites of the Park Lake area and Lava Mountain trailhead might be inconvenienced by the travel equipment along the same road network. The user created trail along the flume would be inaccessible during implementation. Hunting might be displaced due to area closures or the quality of hunting might change.

The recreational setting would be altered due to the clearing of vegetation. Sight lines around Chessman Reservoir would be more open. The trail along the flume would be more exposed. Views out from the flume would be enhanced because obstructing vegetation would be removed. Hunting would be altered or displaced by the removal of hiding cover. As forest succession unfolds, sight lines would diminish. The openings around Chessman Reservoir would fill in with vegetation. The desired future condition of a "shaded fuel break" along the Red Mountain Flume would maintain enhanced views and restore some shade and cover. Hunting would return as vegetative cover re-colonizes. Dispersed camping might be more or less desirable to users.

The proposal would have no effect to the climbing route to the summit of Red Mountain during any time duration.

This proposal would maintain roadless characteristics for the Lazyman Gulch Inventoried Roadless Area (IRA) which lies to the north of the project area. All project activities would occur outside of the Lazyman Gulch IRA and the larger roadless area expanse. Some project activities may be able to be seen or heard from a small portion of the IRA or roadless area expanse, but those indirect effects to scenery would only last for the short-term during project implementation and would subside as the treated units regenerate. Because so much of the IRA and roadless area expanse are surrounded by developed private land and frequently used recreation roads, those sights and sounds would be very similar to the current existing condition and would not affect overall landscape character. There is also the possibility that burning activities associated with the project could have short-terms effects to air quality within the IRA.

In addition, this proposal would not affect the IRA or larger roadless expanses suitability for wilderness designation. Some activities may be able to be seen or heard, potentially affecting the Solitude, but for only the short-term during project implementation and would subside as the project activities conclude and treated units regenerate. For additional details regarding the Lazyman Gulch IRA character and wilderness attributes, please refer to the IRA worksheet in the project record.

Cumulatively, various prior vegetation treatments, such as timber harvests, fuel reduction efforts, roadside hazard tree removals, and firewood cuttings are evident in varying degrees on the landscape and collectively shape the recreational setting. The potential issuance of a special use permit for the management of a 100 foot corridor each side of the flume (total 200 feet) would change the trail's setting but not access. The desired future condition a "shaded fuel break" might enhance the route's setting, offering some dappled shade and unobstructed views. However the majority of the route would

likely be exposed. Due to the dispersed nature of recreation in the project area, its form being created by the recreational user's response to site conditions, it is highly adaptable.

Forest Plan Consistency

Some minor effects are expected from this proposal but they would be short-term in nature and some long-term, ongoing impact not associated with this proposal would continue e.g. firewood cutting. This proposal is expected to remain consistent with Forest Plan goals and standards.

Visual Resources

Analysis has indicated that the proposed activities cannot be viewed from the majority of Sensitive Viewing Areas identified in the Helena Forest Plan, Appendix B. However, the GIS viewshed analysis did indicate portions of the project can be seen from Highway 12 on the east side of MacDonald Pass (those along the flume). While slightly visible, it is only a small portion of the units and is in the background (beyond 4 miles). The VQO for background views for this sensitive area is Partial Retention. It is generally agreed that when viewed from this distance (beyond 4 miles) details begin to become less apparent to the viewer.

No-Action

Natural disturbance regimes and events such as wildfires, wind events, insects and disease will continue to shape and change the vegetation of the project area. Many dead and dying trees could remain standing for several years but will ultimately fall. As trees fall, there will be an increase in woody material on the ground and a reduction in the forest canopy. Shade tolerant species that are latent in the understory will be released and fill light gaps. Patterns of vegetation will reflect natural processes.

Natural processes will continue to unfold on the landscape. Forest succession will ebb and flow through seral stages of development. While some stages might be perceived as unsightly by the viewer, it will be visually seamless. Patterns will be dictated by the biophysical gradients of the landscape.

Various prior vegetation treatments, such as timber harvests, fuel reduction efforts, roadside hazard tree removals, and firewood cuttings are evident in varying degrees on the landscape. With the current trends, as dead trees in the project area begin to fall, boundaries between prior management and the project area will further blend as natural processes continue to unfold. Existing roads will continue to be a part of the landscape and scenery.

Proposal

This alternative would remove dead and dying trees along the flume and reservoir. The effects of the treatments would differ between those adjacent to Chessman Reservoir and those adjacent to the Red Mountain Flume. The effects to scenery would also vary in the short-term and long-term durations.

Openings would be created around the reservoir through regeneration and intermediate harvest. In the short-term, the visual effects would be very evident. In the long-term, as dead trees fall and regeneration becomes established, it would soften the effects of clearing as vegetation re-colonizes. A

regenerated forest of dense lodgepole pine would create a vibrant green apron around the reservoir. The surrounding untreated forests would contrast with the even-aged new generation of vegetation in treated areas. Implementation of design considerations for the layout of treatment units would help to blend the boundaries between treated and untreated forest. While this contrast would be very evident in the short-term, it would lessen in the long-term.

Horizontal linear openings would be created along the Red Mountain Flume. The short-term effects of treatments would be evident in the foreground and middle ground. Background views would be less detailed with only the horizontal linear pattern evident. Long-term management of vegetation along the flume would perpetuate this belt-like opening running Red Mountain's east, north, and west flanks. However, the desired future condition of a "shaded fuel break" would lessen the contrast. Where the flume is close to the tree-line and other natural openings, the contrast would be less apparent. The contrast would be more apparent where the flume is adjacent to contiguous stands of untreated forests. Views of the background out from the flume would be enhanced because obstructing vegetation would be removed. Implementation of design considerations for the layout of treatment units would help to blend the boundaries between treated and untreated forest. While this contrast would be evident in the short-term, it would lessen in the long-term as natural processes unfold.

Vegetation treatments that resemble natural processes, such as hand-piling and burning would have less of a visual effect than mechanical treatments. Regeneration harvests around the reservoir would reflect more obvious man-made intervention, creating geometries that contrast with natural vegetative patterns. The linear and regeneration patterns would blend with natural patterns over time. Maintenance of vegetation along the flume would create a semi-permanent pattern on the landscape.

Various prior vegetation treatments, such as timber harvests, fuel reduction efforts, roadside hazard tree removals, and firewood cuttings are evident in varying degrees on the landscape. The proposal would add to the existing patterns of prior vegetation treatments in the project area. Boundaries between these prior treatments and untreated areas would further blend as natural processes continue to unfold. Existing roads would continue to be a part of the landscape and scenery.

Forest Plan Consistency

The proposal would comply with the VQOs of the Helena National Forest Plan. In contrasting the current trend with the proposal, the current situation would continue to result in patterns shaped by natural processes. The proposal would result in discreet patterns adjacent to the reservoir and flume with varying degrees of contrasts with the surrounding untreated forests in the short-term. The VQO standards for the treatment units according to the Helena National Forest Plan are modification and max modification. Because portions of the project area are visible from an identified sensitive viewpoint, Highway 12, the VQO is restricted to Partial Retention. The treatment units visible from this sensitive viewpoint meet this VQO. Therefore both alternatives comply with the forest plan.

Air quality

This analysis describes the impacts and effects on air quality via smoke impacts in the project area through the current trends and the proposal. The Red Mountain Flume Chessman Reservoir Project proposes various fuels reduction and harvest treatments on 490 acres of the 4760 acre project area.

No-Action

If no treatments occur, there would be no immediate emission contribution to degrade air quality. This would however, lead to increased accumulation of ground fuel causing an increased possibility of high intensity wildfires in the future. This could result in a higher potential for air quality degradation. Wildfires are known to result in high levels of emissions, including greenhouse gases and associated NAAQS violations.

Air quality can be degraded by smoke from wildfires and anthropogenic emissions to the point of human illness in some instances. Smoke from wildfire could also cause visual impacts to the surrounding areas and create hazardous driving conditions on adjacent state, county, and Forest Service roads for extended periods of time. Should a high severity wildfire occur, dust emissions, resulting from fire suppression equipment (both on and off roads) could show a marked increase until seasonal rains soak the surface of the burned area.

Air emissions from a wildfire burning under the no action alternative were modeled and show the PM2.5 emissions in concentrations in µg/m³ for an estimated 170 acres burned per day wildfire. (MacDonald Pass Fire 2009)

Table 42: Concentrations from Wildfire (µg/m³)

	Distance form Wildland Fire (miles)	24-Hour Average $PM_{2.5}$ concentrations (µg/m³)
Fireline	0.1	272.9
	0.5	128.8
Town of Rimini	1.0	45.7
	2.0	28.1
	3.0	24.0
Town of Unionville	4.0	21.7
	5.0	19.8

The modeling results show PM2.5 (particulate matter) projected concentrations of 272.9µg/m³ (micrograms per cubic meter of air) on the fireline and 45.7µg/m³ 1 mile from the fire. When the 8.6µg/m³ average daily PM2.5 (from daily average at Rossiter Pump House) is added as existing daily emissions to the wildfire emissions at one mile, the total PM2.5 concentrations are 54.3µg/m³ , resulting in 19.3µg/m³ above the 35µg/m³ standard.

In an environment such as the Flume Chessman Project where air mixing and dispersal is robust, past impacts to air quality are not usually evident or cumulative. The HNF is currently in compliance with all national ambient air quality standards. The only effect of the current trend on air quality would be the increased risk of a high severity wildfire, which could have a short-term effect on air quality such as localized visibility impacts. If such an event were to take place, the addition of these emissions to existing anthropogenic emissions could break the 35µg/m³ threshold for PM2.5 24 hour concentrations.

Proposal

The proposed project includes the following prescribed fire operations modeled fuel treatments; broadcast, burning hand piles, and jackpot burns. Prescribed fire operations would be completed over a three year period in the spring and fall for prescribed burns and winter for pile burns. Spring burns would likely occur during a period of greater wind dispersion than fall due to longer spring daytime length and higher mixing heights. The smoke plumes would likely disperse to the south and southwest. PM2.5 from burns would not likely impact Helena or East Helena due to the distance from the burns. Some concentrations of smoke might occur near residences in the town of Rimini, 1 mile to the northwest and Unionville, a small community located approximately 4 miles northeast of the project area. This would most likely occur during the burn smoldering phase where smoke could be trapped by nighttime inversions.

During the burn implementation periods, the prescribed burn boss would be responsible for conducting a site specific smoke analysis with current weather and air quality conditions prior to ignition. Using that information, the burn boss would determine how many acres can be burned that day and identify any effects on residents located downwind of the project burn area.

For spring and fall burning, projected 24-hour PM2.5 emissions are below 18µg/m³ at all distances greater than 1.0 mile from the burn. When the average daily emissions from Rossiter Pump House of 5.2µg/m³ are added to the spring burning emissions of 18µg/m³, the resulting emissions of 23.2µg/m³ are below the 35µg/m³ standard. Likewise, fall burning emissions show a total of 26.6µg/m³ when added to the average daily emissions.

Table 43: Prescribed Burning $PM_{2.5}$ Concentrations for Spring and Fall

Red Mountain Flume Chessman Reservoir Project Smoke Model Results Broadcast, Underburn, and Jackpot Prescribed Burning for Spring Months (March to June)		Red Mountain Flume Chessman Reservoir Project Smoke Model Results Broadcast, Underburn, and Jackpot Prescribed Burning for Fall Months (July to October)	
Downwind Distance from Burn Unit (miles)	24-hour Average $PM_{2.5}$ Concentrations (µg/m³)	Downwind Distance from Burn Unit (miles)	24-hour Average $PM_{2.5}$ Concentrations (µg/m³)
0.1	150.5	0.1	151.3
0.2	129.7	0.2	130.4
0.3	107.7	0.3	108.2
0.4	82.9	0.4	83.2
0.5	61.7	0.5	61.9
0.6	45.9	0.6	46.0
0.7	34.5	0.7	34.5
0.8	26.5	0.8	26.6
0.9	21.2	0.9	21.3
1.0	18	1.0	18

Red Mountain Flume Chessman Reservoir Project Smoke Model Results Broadcast, Underburn, and Jackpot Prescribed Burning for Spring Months (March to June)		Red Mountain Flume Chessman Reservoir Project Smoke Model Results Broadcast, Underburn, and Jackpot Prescribed Burning for Fall Months (July to October)	
Downwind Distance from Burn Unit (miles)	24-hour Average $PM_{2.5}$ Concentrations (µg/m³)	Downwind Distance from Burn Unit (miles)	24-hour Average $PM_{2.5}$ Concentrations (µg/m³)
1.1	16.1	1.1	16.1
1.2	15.9	1.2	15.9
1.3	14.1	1.3	14.1
1.4	13.5	1.3	13.5
1.5	12.9	1.5	12.9
2.0	11.1	2.0	11.1

For pile burns, projected 24-hour PM2.5 emissions are below 3.2 µg/m³ at all distances greater than 1.0 mile from the burn for the pile burns. When added to the daily average from Rossiter Pump House, emissions amount to 16.2µg/m³ during winter implementation.

Table 44: Slash Pile Burning $PM_{2.5}$ Concentrations

Downwind Distance from Burn Unit (miles)	24-hour Average $PM_{2.5}$ Concentrations (µg/m³)
0.1	**113.4**
0.2	**64.7**
0.3	**34.6**
0.4	**18.8**
0.5	**11.5**
1.0	**3.2**

In areas with good air mixing and dispersal, air resources are somewhat unique in that the past impacts to air quality are not usually evident or cumulative. The Flume Chessman Project emissions would be cumulative only with other concurrent local emission sources such as adjacent Forest Service Ranger Districts and/or other Forests prescribed burning on the same day, as well as burning for both agricultural and private forestry work. There are very few sources of emissions within the immediate area, less than 2 air miles. However, when expanded to the maximum scope of the air quality analysis area (up to a 100 air kilometer radius), there exists a possibility that emissions from the cities of Helena, East Helena, Boulder, Butte, Montana Tunnel Mines in Jefferson City, and Ash Grove Cement in Clancy, with vehicle exhaust, residential wood burning smoke, road and agriculture dust, and construction equipment may influence the overall air quality, thus limiting the ability to burn on a given day.

The HNF is currently in compliance with air quality standards in all current and ongoing treatments as outlined in the forest plan. Implementation of the action alternative would be compliant with the Forest Plan because all prescribed fire operations would comply with Federal and State standards and the Montana Cooperative Smoke Management Plan.

In evaluating both the current trend and the proposal, with an increased risk of a high severity wildfire, either could have a substantive effect on air quality, such as localized visibility impacts and extended duration health hazards. When coupled with existing anthropogenic emissions, the possibility for above standard PM2.5 is probable.

Forest Plan Consistency

Implementation of the proposal would be in compliance with the Forest Plan by complying with air quality standards by not causing or contributing to any exceedance or violations of Federal or state standards and by cooperating with the Montana Air Quality Bureau in the Prevention of Significant Deterioration program and State Implementation Plan . Smoke concentrations are expected to be within NAAQS and state of Montana air quality standards. The Flume Chessman Project burns would be coordinated with the Montana/Idaho State Airshed Group, and specific restrictions would be implemented when smoke accumulation is probable due to inadequate dispersion.

Weeds

Mapped weed acres account for approximately three percent of the total project area. Many of the weed species occurrences that are mapped overlap each other. There are five documented State of Montana noxious weed species within the project area and are detailed in the next table.

Weed infestations in the project area are mostly linear patches containing all five species along the main roads. There is one five acre area of spotted knapweed near unit 13. All other mapped weeds are located in small patches containing a dozen or so invasive plants.

Table 45: Weeds Present in Project Area

Noxious Weed Species	Acres in Treatment Units	Acres in Project Area
Canada thistle	8	21
Common mullein	8	19
Dalmatian toadflax	17	32
Musk thistle	8	19
Spotted knapweed	20	43
Total	**61**	**134**

No-Action

Noxious weed infestations adversely affect native fauna and flora and present a large-scale threat to native ecosystems (D'Antonio et al. 2004, Lodge and Shrader-Frechette 2003, Lonsdale 1999, Mack et al.

2001, Pauchard et al. 2003). Noxious weeds can negatively alter community structure and ecosystem processes (Levine et al. 2003, Mack et al. 2000), including fire cycles (Brooks 2008). At high infestation levels (canopy cover of ≥25 percent), weeds may cause a loss of native plant diversity (Ortega and Pearson 2010), reduction of wildlife habitat and forage (Thompson 1996), increases in erosion and depletion of soil moisture, soil biota and nutrient levels (Weidenhamer and Callaway 2010), and reduce the aesthetic value of the landscape. These effects are common to all alternatives, particularly along road sides and areas of disturbance (Lonsdale 1999) and would vary depending on the level of infestation. New weed introductions and spread of established populations would continue under all alternatives.

Weeds could potentially spread at a rate of 14 percent per year into dry forest areas as conifer species die and sunlight, nutrients, and moisture are more available to herbaceous plant species (Asher and Spurrier 1998). Noxious weed infestations are introduced and spread through most ground disturbing activities (Young et al. 1987; Lonsdale 1999; Zouhar 2001a, 2002b, 2003b). Activities from this proposal such as the temp road construction, harvest, and prescribed fire are primary activities that have the potential to spread existing infestations as well as introduce new infestations.

The Helena National Forest Weed Treatment Project FEIS and Record of Decision (USDA Forest Service 2006b, 2007a) provide further analysis of effects, guidance and environmental requirements for weed control and treatment activities that would apply to this area under any alternative.

This current situation would have no new soil disturbing activities that tend to increase the risk of weed invasion. Ground disturbance under this alternative would be limited to natural disturbances and existing uses. Although roads in the area would be treated as part of the annual forest-wide treatment schedule, there would be no increased emphasis on the treatment of weeds in this area. Without treatment, the 134 acres of mapped weeds in the project area could be expected to increase by an estimated 14% (an additional 19 acres) (Asher and Spurrier 1998).

The current trend has no new management activities thus would have no impacts in terms of ground disturbance associated with treatment activities. The existing condition reflects the effect of past disturbances as well as the effect of noxious weed control efforts. Existing weed infestations would continue to spread, although treatment on a regular basis would limit this increase as per Helena National Forest Weed Treatment Project FEIS and Record of Decision (USDA Forest Service 2006b, 2007a).

Proposal

Any soil disturbing activity, such as tree removal with mechanized equipment and prescribed fire, has the potential to increase noxious weed invasion or spread. While the spread of noxious weeds would continue as a result of both the no-action and this proposal, the rate of spread could potentially be faster in areas proposed for treatments.

Regeneration and intermediate treatments would create moderate ground disturbance from tractor skidding methods. It is estimated that 10 percent of treated acres in the proposal would be susceptible to new weed infestations due to these treatments (Thysekk and Carey 2001).

The table below displays estimated acres of weed infestation per management activity. The details and assumptions are clearly discussed in the 'Invasives' report filed in the project record.

Table 46: Estimated Infestation per Activity

Treatment Activity	Risk of Infestation	Potential Acres of Activity	Estimated Acres of Weed Infestation
ground based harvest, no seasonal restriction	moderate (10%)	432	0.1 x 432 = 43
ground based landings	high (100%)	43 x 0.25 (size of landing) = 11 acres	11
temporary road construction and obliterations (treat prior to construction and after obliteration)	high (100%)	3.8 (acres/mile) x 0.5 (miles) = 2 acres x 2 = 4 acres	4
acres of haul road (35 ft width either side)	low (3%)	7.5 (acres/mile) x 10 (miles) = 75 acres	0.03 x 75 = 2
hand treatment	low (3%)	58	0.03 x 58 = 2
Acres predicted/potential weed infestation			62

Existing infestations within all treatment units (61 acres) would be treated prior to ground disturbing activities, and all acres monitored as appropriate and in accordance with the HNF Weed Treatment Project FEIS (USDA 2006b) and Best Management Practices (BMP) as specified in Forest Service Manual 2080 (USDA Forest Service 2001). At a minimum, a third of the existing infestations would be treated in years one, two and three after ground disturbing activities (18 acres each year).

Without disturbance, weed infestations in treatment units would be expected to increase by 14 percent from 61 acres to 70 acres. If the estimated 62 acres of new infestations do establish after the proposed actions, the total infestation within the proposed treatment areas would be 123 acres. Project design features (BMPs) require monitoring and treating weeds for several years after project implementation and due to the small size of new infestations, aggressive treatment could eliminate these new infestations with several treatments. Since eliminating new, small infestations is much easier and more cost effective than eliminating large and well established infestations, aggressive treatment of new infestations immediately following project implementation would likely be more effective and less expensive than treatments occurring later. If known infested acres (61 acres) in the treatment units are treated prior to the vegetation treatments proposed by this proposal, seed sources would be reduced and fewer seeds would be available for spread during project implementation.

Weed expansion may continue to occur in association with some ongoing and foreseeable activities. Those activities that could add to the cumulative effects include: routine use and maintenance of open forest roads; the Clancy Unionville vegetation manipulation and travel management project; hazardous tree removal project; private land activities; noxious weed treatment.

Forest Plan Consistency

The effects of the action alternative upon noxious weeds would remain within Forest Plan standards; the design criteria outlined and implemented by unit and species, where appropriate, are consistent with management guidelines. There are no specific management area standards for noxious weed

management in the Forest Plan. This document tiers to the decision in the Noxious Weed EIS and ROD which prescribes specific guidance for noxious weed management on the HNF.

Economics

The management of the natural resources on the Helena National Forest (HNF) has the potential to affect local economies. People and economies are an important part of the ecosystem. Use of resources and recreational visitation to the national forests generate employment and income in the surrounding communities and counties, and generate revenues returned to the Federal treasury or used to fund additional on-the-ground activities to accomplish resource management objectives.

This report delineates the affected area and outlines methods to analyze the economic effects of the project, including the project feasibility, financial efficiency, and economic impacts. Project feasibility and financial efficiency relate to the costs and revenues of doing the action. Economic impacts relate to how the action affects the local economy in the surrounding area.

No-Action

Project Feasibility

Project feasibility is used to determine if a project is feasible, that is, will it sell, given current market conditions. The determination of feasibility relies on a residual value (stumpage = revenues - costs) feasibility analysis that uses local delivered log prices and stump to mill costs to determine if a project is feasible. The predicted stumpage value from this analysis is compared to the base rate (revenues considered essential to cover regeneration plus minimum return to the Federal treasury). The project is considered to be feasible if the stumpage value exceeds the base rates. If the feasibility analysis indicates that the project is not feasible (stumpage value is less than the base rates), the project may need to be modified. Infeasibility indicates an increased risk that the project may not attract bids and may not be implemented.

Financial Efficiency

Financial efficiency provides information relevant to the future financial position of the program if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decision-making process. PNV combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive PNV indicates that the alternative is financially efficient. Financial efficiency analysis is not intended to be a comprehensive analysis that incorporates monetary expressions of all known market and non-market benefits and costs. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited financial efficiency framework. These non-market benefits and costs associated with the project are discussed throughout the document.

Management of the forest is expected to yield positive benefits, but not necessarily financial benefits. Costs for other project activities are based on recent experienced costs and professional estimates.

Non-harvest related costs are included in the PNV analysis, but they are not included in appraised timber value.

Economic Impacts

Economic impacts are used to evaluate potential direct, indirect, and cumulative effects on the economy. The economic impact effects are measured by estimating the direct jobs and labor income generated by (1) the processing of the timber volume from the project, and (2) the dollars resulting from any restoration activities of the project into the local economy affected by the treatments proposed.

Proposal

The estimation of project feasibility was based on the Region 1 sale feasibility model, which is a residual value timber appraisal approach that takes into account logging system, timber species and quality, volume removed per acre, lumber market trends, costs for slash treatment, and the cost of specified roads, temporary roads and road maintenance. The predicted stumpage rate from the feasibility analysis was compared to the base rate (revenues considered essential to cover regeneration plus minimum return to the federal treasury). The stumpage rate and base rate are displayed below in Table 47. The base rate, including essential regeneration costs, is $3.00 per CCF (hundred cubic feet). The appraised stumpage rate is $26.05 per CCF, which is higher than the base rate, indicating that this alternative is feasible and likely to attract bids.

Estimates of timber value are based on current fair market values of timber. Timber markets have fluctuated in the past 5 years, dropping significantly during the 2008 recession, and then rebounding slightly in subsequent years. Current markets have not returned to their pre-2008 levels; however Forest Service timber sales have continued to sell during these challenging markets. A major factor that influences the value of the timber particularly in the Flume Chessman Project area is the quality of the dead and dying lodgepole pine (LP). A large percentage of the volume in this project comes from dead and dying LP, the mortality a result of the mountain pine beetle outbreak that began in 2008 and continues today. Following mortality LP retains its value as a sawlog product for a time. As the tree begins to deteriorate that value as a sawlog diminishes, however the tree may still be viable for other less valuable products. Delays in implementation could negatively affect the feasibility of this timber sale and alter the ability to implement and meet project goals.

Table47: Project feasibility and financial efficiency summary (2012 dollars)

Category	Measure	No Action Alternative	Alternative 2
Timber Harvest Information	Acres Harvested (All)	0	397
	Volume Harvested (Saw) (CCF)	0	4,766
	Base Rate ($/CCF)	0	$3.00
	Appraised Stumpage Rate	0	$26.05
	Predicted High Bid ($/CCF)	0	$31.70
	Total Revenue	0	$151

	(Thousands of dollars)		
Timber Harvest & Required Design Criteria	Present Net Value (Thousands of dollars)	0	$63
Timber Harvest & All Other Planned Activities	Present Net Value (Thousands of dollars)	0	-$177

The financial efficiency analysis is specific to the timber harvest and ecosystem management activities associated with the project (as directed in Forest Service Manual 2400–Timber Management and guidance found in the Forest Service Handbook 2409.18). Costs for sale preparation, sale administration, regeneration, and ecosystem restoration are included. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team. The expected revenue is the corresponding predicted high bid, $31.70 per CCF, from the sale feasibility analysis, times the amount of timber harvested. The predicted high bid is used for the expected revenue (rather than the appraised stumpage rate) since the predicted high bid is the best estimate of the high bid resulting from the timber sale auction. The actual timber value would depend on the market when the timber is sold, and may be higher or lower than the predicted high bid.

This analysis is not intended to be a comprehensive benefit-cost or PNV analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values and costs associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. Therefore, they are not described in financial or economic terms for this project, but rather are discussed in the various resource sections of this report. For instance, changes in fire risk are described in terms of changes in fire behavior, while wildlife resource changes are described in terms of changes to habitat conditions. The previous table summarizes the project feasibility and financial efficiency, including the base rate, stumpage rate, predicted high bid, total revenue, and PNV calculations. One PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest and required design criteria. A second PNV includes all costs for the proposed action, including other restoration activities.

Table 47 indicates that the action alternative is feasible when considering only timber harvest and the required design criteria. Table 4 also indicates that the action alternative is financially inefficient (negative PNV) when including all activities associated with the Decision. The PNV for the proposed action is $63K for the timber harvest and required design criteria, and -$177K for all planned activities.

When evaluating trade-offs, the use of efficiency measures is one tool used by the decision maker in making the decision. Many things cannot be quantified, such as effects on wildlife, impacts on local economies, wildfire mitigation efforts and restoration of watersheds and vegetation. The decision maker takes many factors into account in making the decision.

Table 47 lists the costs included in the PNV analyses, which includes all estimated project costs except for those already included in the timber appraisal. Planning costs (NEPA) were not included in any of the

alternatives since they are sunk costs at the point of alternative selection. Sale preparation costs of $8.50/CCF and sale administration costs of $3.50/CCF were included.

Table 48: Activity Expenditures by Alternative (those not included in appraisal)

Activity	Alternative 1	Alternative 2
Sale preparation	$0	$40,511
Sale administration	$0	$16,681
Non-Commercial Flume Treatments (Hand)	$0	$145,000
Non-Commercial Flume Treatments (Mechanical)	$0	$49,000
Post-Harvest Prescribed Burning	$0	$41,500
Weed Spraying	$0	$9,300

Timber production and fuels reduction activities from this proposal would have direct and indirect effects on local jobs and labor income.

The analysis calculated the jobs and labor income associated with timber harvest, reforestation, and restoration activities. In order to estimate jobs and labor income associated with timber harvest, the timber harvest levels were proportionally broken out by product type. In order to estimate jobs and labor income associated with reforestation and restoration activities, expenditures for these activities were developed by the resource specialists.

Estimates indicate that the proposal would maintain approximately 17 direct jobs spread over the life of the project, or 9 direct jobs annually for the timber harvest activities. These direct jobs would lead to an additional 26 indirect and induced jobs spread over the life of the project or roughly 13 jobs annually. All together, these jobs would provide roughly $791,000 of direct labor income and $1,379,000 in total labor income over the life of the project. When all activities in the decision are taken into account one more direct job is maintained and a total of $817,000 in direct labor income and $1,413,000 in total labor income over the life of the project is contributed to the affected economic impact area.

Using a timber sale to mechanical remove the dead and down trees is expected to generate revenue to the federal government. Mechanical treatment and removal of the dead and down trees without selling them would likely cost the government at a minimum $1500 to $2000 per acre. The financially responsible action for the Forest to take is to sell the trees where it is feasible and not in conflict with other resource values, thereby reducing the overall cost of the project.

The financial efficiency of the project would not be affected by the past, present, or reasonable foreseeable future actions in the project area. Other projects occurring in the economic impact area will have cumulative economic impacts.

Environmental Justice

According to the CEQ's Environmental Justice Guidelines for NEPA (1997), "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the

minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." Data shows that the total share of all minority populations represented less than 10 percent of the population in the state and the analysis area in 2011. Thus, the U.S. Census data suggest minority populations within the analysis area do not meet the CEQ's Environmental Justice criterion.

CEQ guidance on identifying low-income populations states that "…agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (e.g., migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect." Low-income populations are defined, based on the 2010 Census standard, as persons living below the poverty level (based on total income of $22,050 for a family household of four). Persistent poverty status requires a county to have experienced an individual poverty rate in excess of 20 percent for several Census years. In 2011, 6.6% of the population in Broadwater County, 8.9% of the population in Powell County, 3.0% of the population in Jefferson County and 5.9% of the population in Lewis & Clark County were living below the poverty level. Based on these data, the characteristic of persistent poverty is not present in the analysis area.

It is predicted that more employment and labor income opportunities would be created by this proposal. Implementation of the proposal would not likely adversely affect minority or low-income populations. Implementation of the no action option would maintain the status quo and provides no additional employment or income in the economic impact area.

The Executive Order also directs agencies to consider patterns of subsistence hunting and fishing when an action proposed by an agency has the potential to affect fish or wildlife. There are no Native American Reservations or designated Native American hunting grounds located in or near the analysis area. The proposal does not restrict or alter opportunities for subsistence hunting and fishing by Native American tribes. Tribes holding treaty rights for hunting and fishing on the Helena National Forest are included on the project mailing list and have the opportunity to provide comments on this project.

This analysis shows that, overall, when all activities are considered, the proposal would produce more jobs and income than the no-action alternative. It is unlikely, that implementation of the proposal would adversely affect minority or low-income populations.

This project is projected to produce approximately 2.4 million board feet of timber while maintaining 17 direct jobs and 26 indirect and induced jobs spread out over the life of the project. It would begin to implement a strategy designed to lessen the impacts of a wildfire on important infrastructure that delivers water to the city of Helena and lessen resource effects from a potential wildfire.

Forest Plan Consistency

In the Forest-Wide Management Direction of the Forest Plan one of the goals is to "manage the Forest in a manner that is sensitive to economic efficiency". This report displays the project feasibility of the timber sale portion of this project and the financial efficiency of the project as a whole.

AGENCIES AND ORGANIZATIONS CONSULTED

The Forest Service consulted the following groups, Federal, state and local agencies, and tribes during the development of this Preliminary Environmental Document.

FEDERAL, STATE, AND LOCAL AGENCIES:

- City of Helena, Montana
- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- U.S. Natural Resource Conservation Service
- Montana Department of Natural Resources and Conservation
- Montana Fish Wildlife and Parks
- Montana Department of Environmental Quality
- Montana State Historic Preservation Office
- Lewis and Clark County
- Lewis and Clark County Water Quality Protection District

TRIBES

- Confederated Salish and Kootenai Tribes
- Shoshone – Bannock Tribes
- Blackfeet Tribe

COLLABORATIVE LOCAL GROUPS:

- Ten Mile Watershed Collaborative Committee
- Tri-County FireSafe Working Group
- Lake Helena Watershed Group
- Upper Tenmile Source Water Protection Group
- Hometown Helena